

# Euphrates-Tigris Case Study

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## Key messages

- Droughts are a regular and not an exceptional feature in the region. They have significant adverse social, environmental, health, and economic impacts, mainly where rainfed farming is practiced and places where there are existing pressures on water resources.
- These impacts have played a significant role in population movements, including migration, and will continue to do so, possibly with increasing speed, in the future.
- Droughts can play an exacerbating, catalytic, or triggering role in social unrest and political instability when they precede or occur at the same time with social and humanitarian crises such as mass migration, widespread malnutrition, and rural poverty, as in Syria, following the 2006-2010 drought.
- Social unrest and political instability make proper drought management very difficult to implement.
- It is imperative to address the mutually exacerbating relationship between droughts and social and humanitarian issues with a broad approach to food security and water availability, including measures to increase resilience, manage risk, and establish/expand safety nets.
- Tackling droughts at a basin-scale can help facilitate cooperation among the riparians. Evidence from the past involves attempts for cross-border cooperation over coping with droughts and drought management. However, drought resilience dwindles in the region due to prolonged conflicts and economic decline.
- Innovative drought strategies can significantly support resilience building and adaptive capacity development at a regional scale at national and sub-national levels.
- There is good room to align policies for disaster risk reduction, climate change mitigation and adaptation, and sustainable development.

## Bio-physical and socioeconomic characteristics of the basin area

The Euphrates–Tigris River Basin (ETB), shown in Fig. 1, is a transboundary basin with a total surface area of 879790 km<sup>2</sup> and covers Iraq, Turkey, the Islamic Republic of Iran, the Syrian Arab Republic, the Kingdom of Saudi Arabia, and the Hashemite Kingdom of Jordan (Lehner et al., 2008). Iran is riparian only to the Tigris, and Jordan and Saudi Arabia are riparian only to the Euphrates. Both rivers originate in eastern Turkey. The basin is characterized by high mountains to the north and west and extensive lowlands to the south and east. Two-thirds of their courses go through eastern Turkey's highlands and valleys of

the Syrian and Iraqi plateaus before reaching the arid Mesopotamia plain (Kibaroğlu, 2002). They join <sup>1</sup>, near Qurna, Iraq, to form Shatt Al-Arab and drain into the Persian Gulf.

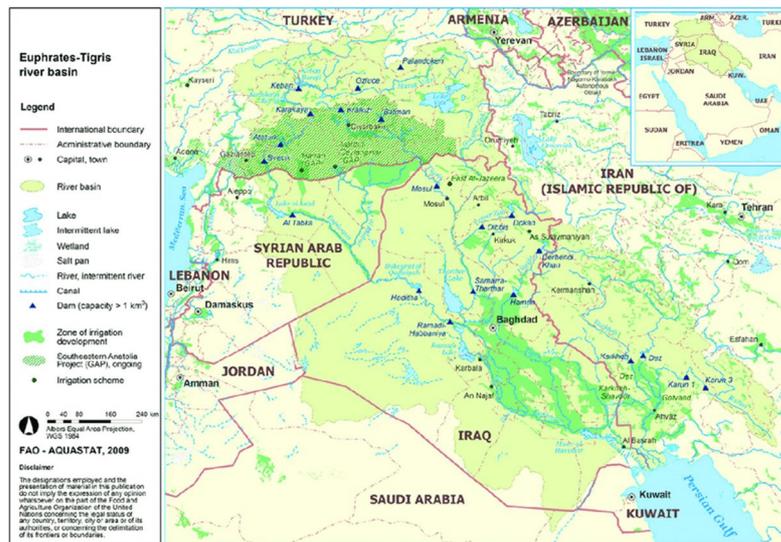


Figure 1. Euphrates-Tigris River Basin (FAO, 2009)

Sub-tropical Mediterranean climate, characterized by wet winters and dry summers, prevails in most of the basin. The mountainous headwater areas contribute to the flow-through snowmelt in the Spring, augmented by seasonal rainfall, with its maximum during the March-May period. Turkey contributes 89 percent (31.6 BCM) and Syria 11 percent (3.4 BCM) of the annual water volume of Euphrates (35 BCM), while 28 percent of its basin area lies in Turkey, 17 percent in Syria, 40 percent in Iraq, 15 percent in Saudi Arabia, and 0.03 percent in Jordan. The exact figures for Tigris are 51 percent or 20.8 BCM (Turkey), 39 percent or 26.5 BCM (Iraq), and 10 percent or 4.7 BCM (Iran) for the annual water flow volume of 52 BCM and 12 percent (Turkey), 0.2 percent (Syria), 54 percent (Iraq) and 34 percent (Iran) for its basin area (FAO, 2016, and Altinbilek, 2004). There is no contribution to flow from Saudi Arabia or Jordan. Besides, FAO (2018) reports that Iraq has vast groundwater reserves in aquifers along the Euphrates River. Average annual precipitation in the Euphrates–Tigris River Basin is estimated at 335 mm, dropping to 200 mm in the Mesopotamian Plain and as high as 1045 mm in upstream locations in the basin (FAO, 2009). Summers in the plain are very hot and dry, with midday temperatures as high as 50 °C and with daytime relative humidity as low as 15 percent.

The Euphrates and Tigris waters stand to be strategic for the major riparians: Iraq derives most of its fresh water from the two rivers. Although the Euphrates basin is one of seven river basins in Syria, it is strategically the most important because of its existing and potential uses for agricultural and hydropower purposes. The Euphrates-Tigris Basin is one of the 25 basins in Turkey but accounts for nearly one-third of the country's surface water resources and one-fifth of its irrigable land.

Turkey had long been dependent on oil imports. Hard hit by the oil crises of the 1970s, the country made strides towards indigenous resource development, with particular emphasis

<sup>1</sup>Euphrates and Tigris have been connected by several man-made channels within Iraq.

on hydropower to reduce the economic dependency on imported oil. Turkey's multi-sectoral development project, known as the Southeastern Anatolia Project (GAP, in its Turkish acronym) has a strong energy component in its broader socioeconomic development objectives. The project includes 21 large dams, 19 hydropower plants, and irrigation schemes extending to 1.7 million hectares of land in the ETB (Ünver, 2006).

The Syrian economy has traditionally been dominated by agriculture. Exploration for oil did not begin until the early 1980s. Even though oil made a significant contribution to export earnings in the following decades as world oil prices fluctuated, Syria focused on agricultural development to achieve food self-sufficiency, which led to plans for developing rural areas and improving rural livelihoods. The Euphrates Valley Project developed for this purpose aimed at irrigating 640,000 hectares, producing hydroelectric energy to cater to urban and industrial needs, and regulating the Euphrates to control seasonal flooding through the multi-purpose Tabqa or Al-Thawra Dam.

Iraq, since 1958, has changed from an agriculture-dominated economy to an oil-producing, semi-industrial one and, as a result, has had to import food. Following the nationalization of the oil companies in 1972, which brought more income from oil, the focus turned to agricultural production, which led to an expansion of irrigated areas to achieve national food security.

In the contemporary context, Turkey's largely free-market economy has been growing steadily despite recent declines. On the other hand, its dependence on imported oil and gas continues. Thus water resources development for hydropower and other purposes, particularly in the ETB, still stands as a strategic objective. Despite the severe domestic security and structural problems, the Iraqi economy has grown significantly in the last decade. Thus, the Iraqi government is eager to continue water resources development in the ETB. Syria's economy continues to suffer the effects of the ongoing conflict that began in 2011. The economy further contracted because of the international sanctions and reduced domestic consumption and production, and inflation has risen sharply. It would be reasonable to expect that once the peace is restored in Syria, urgent attention will need to be paid to the efforts of reconstruction and rehabilitation of existing domestic water supply and sewage systems and irrigation and energy infrastructure, possibly delaying further expansion and development in the ETB.

### **3. Specific drought characteristics of the area**

Drought is an integral part of the arid and semi-arid climates prevalent in the region and is not an exceptional phenomenon. FAO (2018, p. 71) states that the Euphrates-Tigris river system's flows were reduced to half of the average annual flow in drought years over the past three decades. Moreover, the situation could be significantly worsened as IPCC projections indicate a 29 percent decline in Tigris flows, and 73 percent in the Euphrates flows in the future as a result of reduced precipitation in the upper catchments in Turkey (Voss et al., 2013). Developments in the basin involving both extensions of irrigation and intensification of agriculture, consumptive and inefficient uses, and inter-basin transfers can also be expected to exacerbate the situation and evaporation losses from reservoirs whose possible role in mitigating and managing droughts, remains largely unaddressed.

a. Frequency and severity of droughts (trends and projections)

An examination of the precipitation trend in the 20<sup>th</sup> century and into eight years into the 21<sup>st</sup>, as depicted in Fig. 2, demonstrates various dry periods in the basin, especially during the past 50 years, with more frequent droughts in recent years. A good part of the change in the frequency in the recent decades is the impacts of climate change. Since Turkey, Syria, and Iraq are located in the Mediterranean macro climate region in the sub-tropical zone, great rainfall variations exist from year to year, leading to regional and widespread droughts of various intensities. Thus, drought is both prevalent and a main problem for the basin.

Iran's long history with droughts has demonstrated a trend over the last two decades towards more prolonged, extensive, and severe. The droughts of 1998–2001 and 2003–2011 affected many farm families and rural communities across most of central, eastern, and southern Iran (Eskandari, 2001). Syria, too, has been hit by droughts of increasing severity, with major impacts on agricultural production, during 1970-1973, 1977-1979, 1983-84, 1989, and 1999-2001 (FAO, 2018), and four consecutive years starting in 2006. Rainfall in eastern Syria fell to 30 percent of the annual average in 2008, making it the worst drought in 40 years (FAO, 2018). Among these four countries, Turkey has the lowest severity and frequency of drought among the riparians, and Syria has the highest.

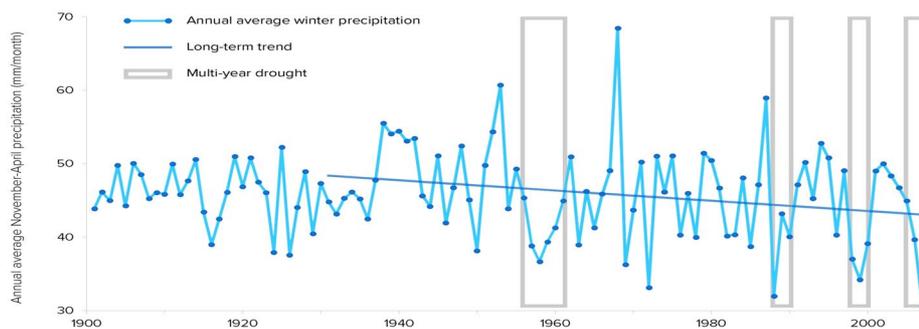


Figure 2. Long term precipitation trend in the Fertile Crescent (LaFond, 2016)

#### b. Socioeconomic, environmental, and cascading impacts

Droughts in the basin have major adverse impacts on the heavily dependent populations on agriculture for their livelihoods. Frequent droughts make livestock, rainfed, and irrigated farming vulnerable. Lack of safety nets, social protection, or solidarity schemes, compounded with a high prevalence of subsistence farming and the systemic weaknesses in the commercial agricultural operations present a picture of recurring social and economic adversities with sporadic, yet severe, spiraling failures leading to loss of rural livelihoods, major pressures on cities, and breakdown in food production and supply chains, with implications for social and political unrest. Direct and indirect environmental consequences of varying severity across the basin countries emanate from inadequate or ineffective environmental legislation, low level of compliance, weak institutional capacities, and the mutually exacerbating impacts of droughts and farming practices and include desertification, land degradation, increased soil salinity, and compromised soil fertility. Cascading impacts on economic sectors and activities, including industry and tourism, exist with nuances among the basin countries according to the development of urban-rural linkages and the nature of the industries, with the greatest relevance in Turkey.

In Iraq, domestic production is well below the food demand making food security reliant on imports, which peaked between 2006 and 2008, when the drought hard-hit crop production and livestock. The number of food-insecure Iraqis amounted to 1.9 million, or 5.7 percent of the population in 2011, according to WFP (2012). Droughts cause food insecurity and poverty to increase, particularly in rural communities, where livelihoods depend on farming, safety nets are weak, and resilience is low. Water scarcity, desertification, and drought have accelerated population displacements. In the past, many people were moved in the south of Iraq due to the drainage of the Marshlands. The 2006-2010 drought caused the displacement of over 25000 individuals between December 2007 and June 2009, and the number of registered cases of disease transmitted through contaminated water and food peaked between 2007 and 2010 (UNESCO, 2014). The most vulnerable groups to drought are rural inhabitants in general, farmers and herders ('bedouins') using marginal lands, internally displaced persons, communities under the poverty line, and women head of households (UNDAF, 2014).

In Syria, the reliance of agriculture on rainfall is the determining factor for vulnerability, particularly in rural areas. The 2007-2008 period saw three-quarters of the 206000 households in these areas suffer crop failure, while 30000 and 50000 small-scale farming families migrated to urban areas in 2009 and 2010, respectively, emptying up to 70 percent of many rural areas (FAO, 2018). Some sources put the total number of migrants during the drought as high as 1.5 million (IRIN, 2009; Solh, 2010).

In Iran, during the 1998-2001 drought, inhabitants of thousands of villages migrated to nearby cities, with a UN Technical Mission to Iran putting these numbers as high as over 60 percent of the rural population (FAO, 2018). The extreme drought conditions of the period 2003–2011 also led to widespread rural-to-urban migration (Keshavarz et al., 2013).

Agriculture is the first and most vulnerable sector to drought, particularly under rainfed conditions. Turkey irrigates a total area of 5.5 million hectares, responsible for over 72 percent of the country's water withdrawals. Currently, a little over ten percent of this total irrigation is in the Turkish part of the Euphrates-Tigris Basin, and this share is projected to increase to over 25 percent when the GAP project is completed. Despite the efforts and incentives to extend water-saving technologies such as drip and sprinkler irrigation, surface irrigation methods' widespread use remains a concern. Only 6 percent of the irrigated area is under sprinkler and drip methods. Agriculture is responsible for 27 percent of the overall workforce and 9 percent of GNP. The record-setting drought in the Euphrates-Tigris Basin took a toll in Turkey, amounting to about US\$2 million in damages, with 435 000 farmers severely affected in the country. The production losses were estimated at 90 percent for wheat and other grains and 60 percent for red lentils in the Turkish part of the basin (FAO, 2017).

The 2006-2010 drought revealed the vulnerabilities and the level of preparedness. Syria, suffering the gravest consequences, is far more vulnerable to drought, due to its stronger dependence on year-to-year rainfall and declining groundwater for agriculture (Kelley et al., 2015). The total annual water withdrawal as a percentage of internal renewable water resources is highest in Syria at 160%, followed by Iraq at 80% and Turkey at around 20% in 2011 (Breisinger et al., 2012). Besides, Turkey's geographic diversity and investment in its southeast region's agricultural infrastructure, coupled with a more organized drought response, allowed it to better tackle the drought, while for Iraq, the difference with Syria was most marked in the lower reliance of the population in northwest Iraq and its economy on

agriculture than their counterparts in northeast Syria (USDA, 2008 and Eklund & Pilesjö, 2012).

c. Drought as linked to civil unrest and conflict in the basin: the 2006-2010 drought

The severe four-year drought that began in 2006 in the lower part of the Euphrates-Tigris Basin was the most severe drought in four decades with devastating social, economic, and political impacts on the basin's riparians in varying degrees. Fig. 3 demonstrates how extensive and massive the impact of the drought on vegetation in the region was. The image depicts vegetation between 7-22 April 2009 as observed by the Moderate Resolution Imaging Spectroradiometer on NASA's Terra satellite. Brown, green, and tan colors respectively indicate less, more, and average plant growth than the average between 2000 and 2008. The drought-affected area is distinct from an arc from northern Syria to northern Iraq to southern Iran.

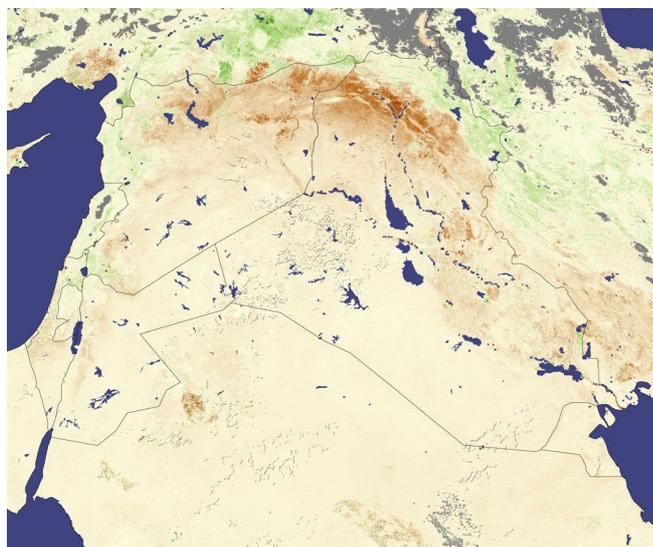


Figure 3. Drought in the lower part of the Euphrates-Tigris (NASA, 2009)

In Iraq and Syria, rural communities lost their livelihoods due to widespread crop failures and livestock mortalities. The agricultural system in Syria's northeastern "breadbasket" region collapsed, amounting to the loss of some two-thirds of the country's crop yields. The drought and its consequences, including price hikes in foodstuff, massive loss of income, large scale migration to urban centers, and other cascading socioeconomic ills, further exacerbated the social unrest in Syria, contributing to (Selby et al, 2017) or triggering (Kelley et al., 2015) the Syrian uprising of 2011. In Iraq, the winter wheat crop cultivation, which depends on precipitation from October to April, lost most of the harvest (NASA, 2009), representing a major drop in Iraq's total grain production, of which 85 percent is winter wheat. The drought also significantly reduced the water volume entering the Tigris and Euphrates Rivers. Reduced surface flows led to over-exploitation of groundwater, drying out the underground aqueducts ('karez'), causing large-scale population displacement. This resulted in several diplomatic exchanges, including a request on June 7, 2009, by the Iraqi government for Turkey to release more water from dams on the Euphrates; Turkey agreeing to do so; Iraq raising the issue in September again because the increased flow was intermittent; and Turkey linking the intermittency to the extreme low inflows due to the drought and reductions made by Syria (Reuters, 2009, and Circle of Blue, 2009). Earlier in 2008, Syria agreed with Turkey (IRIN, 2009) to draw 100 cubic meters per second of water

from the trans-border Tigris River for irrigating 150000 hectares of farmland in Hasakeh, the worst drought-hit governorate, in an effort to help provide farmers with water to irrigate their lands in case rainfall continued to fail, which it did.

#### **4. Drought management/mitigation and adaptation options in the basin**

##### **a. Plans, policies, and legislation in the basin countries**

Turkey: has recently introduced risk management policies and practices along with a Drought Management System (DMS), which is risk management-oriented, informing a comprehensive national policy setting to provide a coordinated and integrated approach. The main beneficiaries of DMS are local stakeholders who are engaged through sub-national administrations in coordination with the national institutions. The local administrations in Turkey, cascading from provinces to villages, are Governorates, Municipalities, Metropolitan Municipalities, Special Provincial Administration, District (town) Administration, and Village Administration. The General Directorate of Meteorology is the national entity dealing with meteorological drought. General Directorate of Water Management and General Directorate of State Hydraulic Works, both operating under Ministry and Agriculture and Forestry (MAF), focus on hydrological drought. As the coordination body for agricultural drought, MAF ensures that the national drought action plan is implemented in light of observations, models, and projections and through the cascade of public administrations. Their collective portfolio includes a national drought monitoring system, a drought management plan for the part of the Euphrates-Tigris Basin within Turkey's territory, and a series of drought mitigation measures, which include underground storage of water, to alleviate drought impacts. Among the riparians of the basin, Turkey's economy is better positioned to alleviate drought impacts and compensate for the production and livelihood losses caused by the drought. A national-level implementation guide for the farming sector, the Turkish Agricultural Drought Action Plan establishes the preparedness and drought mitigation measures (FAO, 2017).

Iraq: The recent United Nations Development Assistance Framework (UNDAF) for 2015-19 lists drought as a severe disaster risk along with land degradation and limited supplies of clean water, and highlights the need for improved capacities for prevention, early warning, response, and resilience (UNDAF, 2014), by acknowledging that "drought and poor land management have increased the intensity and frequency of sand and dust storms, as well as increased land degradation and the threat of desertification and their related socioeconomic implications" with significant impact on agricultural production and food security in Iraq. The country's highly centralized public administration system brings about many ministries and agencies' involvement in dealing with droughts. FAO (2018) describes the government's policy as *reactive*, which entails provision of drinking water tanks for communities, seed, fertiliser, agricultural equipment, and crop loss settlements, while little effort is made to mitigate the effects of the cyclical droughts and no formal plan is in place, apart from ad hoc measures during emergencies. Relief actions are sometimes implemented by civil society institutions, international humanitarian agencies, Iraq Red Crescent, and International Committee of the Red Cross/ Red Crescent, among others (Goodyear, 2009). UNESCO (2014) reports that higher-level committees further support coordination between the Ministries of Water and Agriculture during a drought event. Other Ministries, central government agencies, and municipal governments may be involved on a case-specific basis. According to UNESCO (2014), twelve out of the eighteen Governorates and the Kurdish Regional Government are reported to have experience with droughts,

although they lack concrete action plans. In a drought season, the Ministry of Water Resources and the Ministry of Agriculture immediately form a bilateral committee to decide upon the water shares allocated to the agricultural sector, the areas to be irrigated, the types of crops to be allowed (both winter and summer crops), as well as the compensation to be allocated for farmers in response to crop loss. The Higher Committee for Drought is a promising improvement for coordination. There will be further improved for institutionalized drought risk management, clearly defining tasks rather than committees' formation (FAO, 2018). UN agencies, development partners, and other international entities have projects targeting drought management. These include a UNDP (2011) framework study for drought impact assessment, recovery, and mitigation for the Kurdish Regional Government; a UNDP-UNESCO (2011) study to examine the development of a national integrated drought risk management framework; another UNDP (2013) assessment study for drought vulnerability; and analysis by UNESCO (2014) furthering the framework's conceptual development.

Syria: The National Government has been taking steps to tackle droughts, which include adopting a National Drought Strategy with implementation guidelines, creating an Inter-Ministerial Committee directly headed by the Ministry of Agriculture, and the establishment of Directorate for Drought Management to identify drought-prone areas, build a new early warning system and set up emergency plans (FAO, 2018). The UN Country Team has helped the government with a Syria Drought Appeal in 2008 and a UN Syria Drought Response Plan in 2009. An early warning system office and a steering committee were organized, and a set of drought indicators were identified. The collection, organization, and processing of drought monitoring data (physical and social data) was established, and monthly drought bulletins were produced in 2005 in English and Arabic (Erian, 2011).

Iran: Iran has a 'National Strategy and Action Plan on Drought Preparedness, Management, and Mitigation in the Agricultural Sector, which was developed with support from the Food and Agriculture Organization (FAO) of the United Nations from 2004 to 2006 (ISA, 2015). Various governmental entities are involved in drought management, including the Ministry of Interior Country Drought Headquarters, to assess the drought impact and allocate aid and compensation to farmers, in cooperation with other ministries such as the Ministry of Jihad-e-Agriculture (FAO, 2018). The other main ministries and organizations are Iran National Drought Warning and Monitoring Centre, National Committee of Agricultural Drought, Iranian Space Agency, Agricultural Bank, Insurance Fund of Agricultural Products, and drought and/or water offices of planning and line ministries. Iran National Drought Management Centre and the Provincial Drought Management Committees work together to respond to drought emergencies and coordinate with NGOs and institutions that provide help (FAO, 2018).

b. Issues with implementation and compliance, opportunities for improvement, and transboundary cooperation

Issues include, with varying degrees, lack or weakness of legislation, respective rules and regulations, and compliance for drought management and contingencies; lack of effective vertical and horizontal coordination; low institutional and human capacities; and the detached nature of drought policies from agricultural policies on the one hand, and from broad climate and sustainable development policies on the other hand. While a different subset of the above applies for each basin country, political instability, conflict, and security issues are added to the list for Iraq and Syria.

### c. Transboundary cooperation

Many analysts, including FAO (2009), Ünver (2006), Al-Ansari et al (2018), and Kibaroglu (2000, 2019), inter alia, point out to the complexity and multi-dimensional nature of the transboundary cooperation in the Euphrates-Tigris Basin, and the role of broader politics in reaching a basin-wide agreement that could facilitate cooperation in the management of the Euphrates and Tigris rivers, which by nature would incorporate collaboration in drought management. FAO (2018, p. 72), in an analysis of Iraq's drought vulnerability, stresses that the absence of international water-sharing agreements among the three basin states (Iraq, Turkey, and Syria) may result in instability of available water resources from one year to another. In the absence of a comprehensive, basin-wide agreement, the basin states have been using bilateral agreements and bilateral contacts, including for dealing with droughts. These include agreements between Turkey and Syria in 1987, Syria and Iraq in 1990, Turkey and Syria in 2001, Syria and Iraq in 2002, and Turkey, Syria, and Iraq in 2008 (FAO, 2009, pp.7-8), and most recently Turkey-Iraq and Turkey-Syria in 2009 and Turkey-Iraq in 2014 (Kibaroglu, 2021). The political turmoil, conflict, and instability that has prevailed in Iraq and Syria and the interstate issues with roots going back many decades and spread over topics broader than water are yet to provide a conducive environment for furthering cooperation towards long-term solutions or arrangements. However, it would not be far-fetched to hope that tackling common problems such as climate change and droughts would potentially be perceived by all riparians as a basis for win-win solutions, and progress would be made once some stability is achieved. The examples provided in this report and the

#### Box: Ad-hoc cooperation: Ilisu dam example

There are evidences from the past which involve attempts for cross-border cooperation over coping with droughts and drought management.

Turkey completed the construction of the Ilisu Dam on the Tigris River in early 2018, and began filling the reservoir behind the dam in June 2018. Increasing objections from Iraq led to discussions between Turkey and Iraq, who have since agreed that Turkey would allow the river's natural flow to continue until 1 November 2018. The decision came amid a drought in Iraq, which affected farmers, leading to violent protests against the government in the country. During a press conference, Hassan al-Janabi, Iraq's Minister of Water Resources, said meetings would continue between the two countries on how to ensure enough water flows to Iraq during and after the filling of the reservoir behind the dam. Turkey postponed the filling until July 2019, bearing a delay of several months in energy production.

In the same vein, even though they could not be put into practice due to regional instability and increased political tensions between the riparian states, the bilateral Memoranda of Understanding between Turkey-Iraq and Turkey-Syria signed in 2009 incorporate clauses about the intention to develop a joint mechanism for coping with droughts (Kibaroglu, 2019).

Cooke et al (2020) assert that despite heightened tensions between Iraq and Turkey, there is much potential for collaboration over water management given that "Turkey's elevated geography and cooler climate mean its water reserves suffer 75% less evaporation than Iraq's" and that "Turkey's top energy priority is the diversification of its supply of imported hydrocarbons", making a win-win deal plausible.

references cited offer more hope than despair for cooperation in managing water resources and drought management in this region.

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