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Water Scarcity, Mismanagement and Pollution in Syria

Joseph Daher

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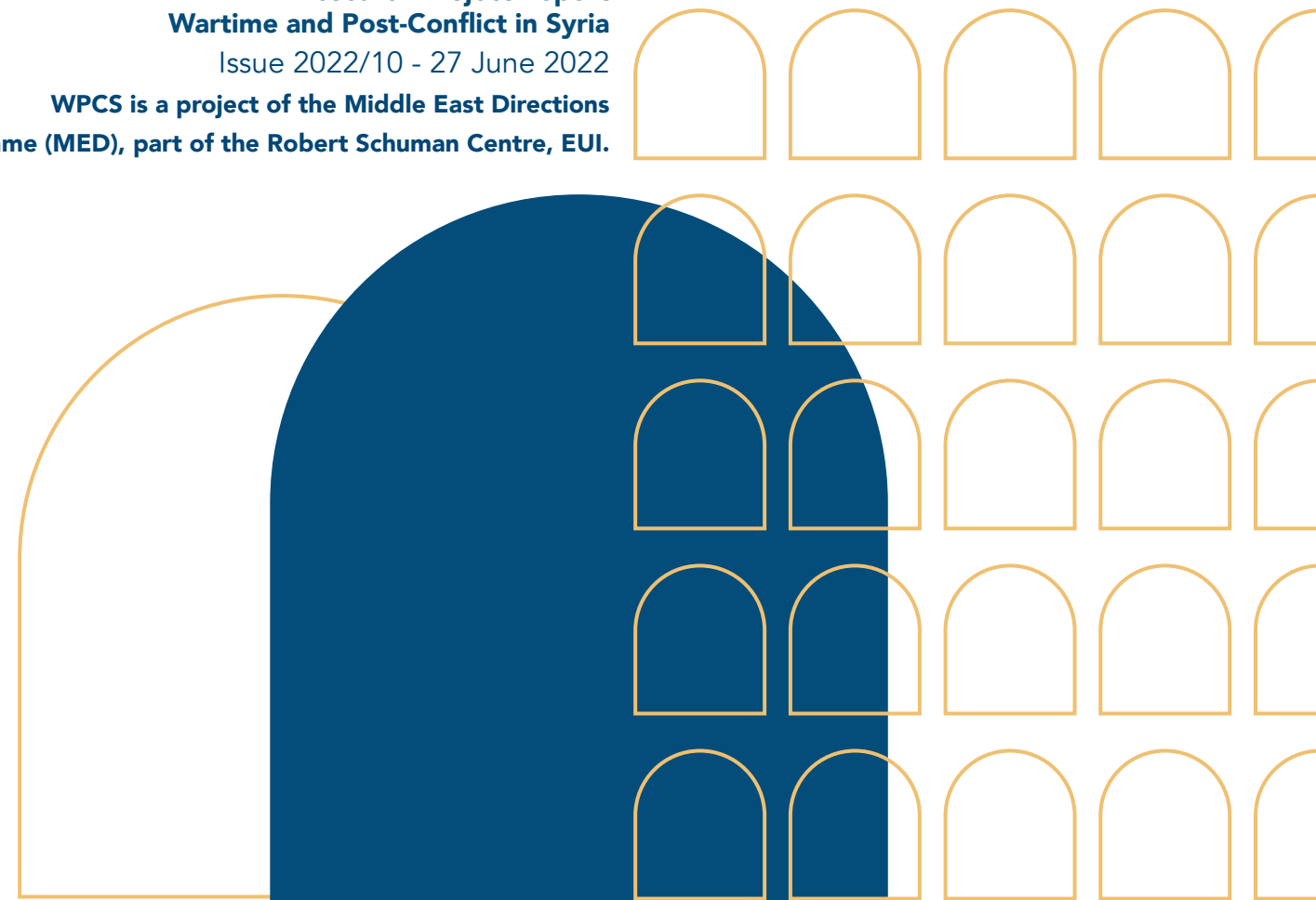

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Executive Summary

Water scarcity, mismanagement and pollution were growing concerns in Syria before 2011. Destruction of and damage to water infrastructure caused by the war, however, have considerably increased the previous shortcomings. Agriculture has been the economic sector most affected, with impacts on its production structure. The population has also suffered from water shortages and pollution. Diseases have spread and continual increases in water prices have more and more impacted family expenditure in a context of sustained daily cost of living rises.

Water scarcity and pollution constitute serious obstacles in any economic reconstruction process, and particularly affect agricultural food production and the well-being of the population. In Syria this is taking place alongside other factors, including shortages and high energy prices (fuel oil, gas and electricity). The effects of climate change will only further exacerbate the various predicaments related to water scarcity and pollution in the future.

Introduction

Water scarcity has been worsening in the Middle East and North Africa (MENA) region as a result of state policies, mismanagement, conflicts and climate change. In 2013, the region received only 2.1% of world average annual precipitation and contained only 1.2% of renewable water resources, while its population amounted to more than 5% of the global population and its land occupied about 10% of the world's land area. In the same year MENA's internal renewable water resources received only 6% of its average annual precipitation, against a world average of 38%.[1] In 2020, more than 200 million people in the Arab-speaking countries of the region lived in a condition of water scarcity and 160 million in absolute water scarcity.[2]

Syria has been increasingly suffering from water scarcity, with dire consequences for its population and economy. Before the outbreak of the uprising in mid-March 2011 the country witnessed several years of severe drought (1999-2001 and 2006-2009), which resulted in population displacements and a reduction in the supply of water, sanitation and hygiene (WASH), particularly in rural areas. The renewable water resources in Syria were estimated at 808m^3/capita/year in 2012, which is below the water scarcity threshold of 1000 m^3/capita/year.[3] It was expected that the absolute water scarcity threshold (500 m^3/capita/year) would be reached by 2050 but climate change, developments in the upstream country, Turkey, and the consequences of the war have only intensified and accelerated water scarcity and pollution problems. In fact, in 2015 Syria was ranked among the 25 countries most likely to face extreme water stress by 2040.[4]

Much recent literature tackles water scarcity from a humanitarian angle or in terms of humanitarian needs by looking at particular impacts on certain sectors, including the environment,[5] energy and agriculture,[6] or on particular regions, such as north-eastern Syria.[7] In addition, the use of water as a weapon of war and bargaining tool has also been largely addressed in the past decade.[8] In contrast, this report aims to analyse how water scarcity and pollution affect agriculture, which is the main economic sector in terms of water needs and utilisation, in its production structures and outputs at the macro-level, and how the supply of water and access to it have created a new additional financial burden on the population.

The paper first presents an overview of Syria's water resources and the state's water management policies before 2011, together with the growing concern in Damascus over water scarcity and pollution. It then looks at the worsening challenges during the war, such as destruction of and damage to water supply infrastructure, transborder flows, the lack or absence of power and energy resources, and corruption. Finally, the study analyses the impacts of water scarcity and pollution on the agricultural sector and the population.

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1 UNDP, "Water Governance in the Arab Region: Managing Scarcity and Securing the Future," 2013, https://bit.ly/33EwNFA

2 UN-ESCWA, "Status Report on the Implementation of Integrated Water Resources Management in the Arab Region," 2021, https://bit.ly/3xIDEdo

3 Aden Aw-Hassan et al., "The Impact of Food and Agricultural Policies on Groundwater Use in Syria," *Journal of Hydrology,* Volume 513, 2014, 204-215.

4 Andrew Maddocks, Robert Samuel Young and Paul Reig, "Ranking the World's Most Water-Stressed Countries in 2040," *World Resources Institute,* 26 August 2015, https://bit.ly/3oV9dfj

5 Haian Dukhan and Gianluca Serra, "COP26: Syria is a Warning of Climate Disaster that Region Cannot Ignore," *Middle East Eye,* 13 December 2021, https://bit.ly/3wQ08HW

6 Operations and Policy Center, Nick Lyall and Karam Shaar, "Three Signs of Impending Famine in Syria Absent Immediate Action," *Middle East Institute,* 10 December 2021, https://bit.ly/3GlMkJC; Aurora Sottimano and Nabil Samman, "Syria Has a Water Crisis. And It's Not Going Away," *Atlantic Council*, 24 February 2022, https://bit.ly/3lJP2yS

7 OCHA, "Water Crisis in Northern and Northeast Syria – Immediate Response and Funding Requirements Monthly Monitoring Report – October 2021," *Relief Web*, 2 December 2021, https://bit.ly/3wO9OCH; Bartholomäus Laffert and Daniela Sala, "Conflict and Climate Change Collide: Why Northeast Syria is Running Dry," *The New Humanitarian*, 20 December 2021, https://bit.ly/38HbPsx

8 Tobias Von Lossow, "The Role of Water in the Syrian and Iraqi Civil Wars," *Italian Institute for International Political Studies*, 26 February 2020, https://bit.ly/3lMJzqY; Wim Zwijnenburg, "Killing the Khabur: How Turkish-Backed Armed Groups Blocked Northeast Syria's Water Lifeline," *Pax For Peace*, 3 November 2021, https://bit.ly/39PFjV5; Samuel Northrup, "The Growing Power of Water in Syria," *Washington Institute*, 12 September 2017, https://bit.ly/3PHJDWL

The research for this study was primarily conducted using reports by international organisations, official media coverage and academic research papers. These open sources were supplemented with interviews with experts in the field of WASH and agriculture active in Syria conducted between January and May 2022.

1. The Politics of Water Management and Consumption before 2011

In the decades prior to 2011, the Syrian state considerably developed its ability to manage water sources and water utilisation. At the same time, successive government policies were the main factors driving water scarcity and pollution, together with recurring droughts, the rising water needs of the urban population and the agriculture sector, water pollution, poor sanitation because of wastewater discharges and increasing sea water intrusion.[9]

1.1 Syria's Water Resources and Water Distribution

To increase its capacity to use water, after 1963 Damascus pursued a policy of investing in diverse types of infrastructure, including dams, irrigation systems and wastewater treatment plants to source and control the movement of water toward the local population and agriculture. This was in the context of an expansive Syrian government agriculture policy to attain 'food security' and self-sufficiency in key crops, which led to over-exploitation of ground water in the following decades. This strategy was underpinned by massive development of irrigated areas, which more than doubled from 625,000 hectares in 1985 to 1.6 million hectares in 2010, an estimated 30% of all cultivated land. Irrigation sources included rainwater, groundwater and surface water (e.g. river water), and they varied from region to region. The main source of water was groundwater, which before 2011 covered 53% of irrigated land.[10]

Syria has also relied on more than 160 dams, most of which were built between 1963 and 2001. The most important one is the Tabqa dam (also known as the 'Thawra dam') It is close to the city of Raqqa on the Euphrates River and was finished in 1973. This dam created Lake Assad, the country's most important water reservoir, which furnishes most of Aleppo's drinking water. In addition, there are seven medium-sized dams (Al-Rastan, al-Baath, Bassel al-Assad Katineh, Tishrin, al-Kabir al-Shemali, Basel al-Assad and Muhrada) and around 140 surface dams, which collect rainwater to be employed for domestic and agricultural purposes. The Tishrin dam, which was built in 1999, is, for instance, a medium-sized hydroelectric dam near Manbij city on the Euphrates River which supplies electricity to the Raqqa and Aleppo governorates.[11]

Syria has concluded trans-boundary water agreements with its neighbours to secure defined quantities, although their implementation has not been successful and there are uncertainties about the volumes of water delivered. This has been a particularly sensitive issue as around half of Syria's annual renewable water resources originate from cross-border flows, with the majority flowing in from Turkey by way of the Euphrates. There has, however, been no global agreement between Syria, Turkey and Iraq on sharing water resources from the Euphrates, which is the third longest river in the Middle East after the Nile and the Tigris. A protocol on economic cooperation was concluded in 1987. This was an interim agreement between Turkey and Syria that 16 billion m3 (1 cubic meter is equivalent to 1,000 litre) of water were to be released at the Syrian-Turkish border annually. Turkey and Syria held new meetings in 2001 to examine water-related socio-economic development activities. They first published a joint communiqué

9 Ghaleb Faour and Abbas Fayad, "Water Environment in the Coastal Basins of Syria – Assessing the Impacts of the War," 2014, https://bit.ly/3H19tk9; Pip Cook, "War or Peace? In Syria, Water Flows Both Ways," *Geneva Solution*, 2021, https://bit.ly/39SlpZM

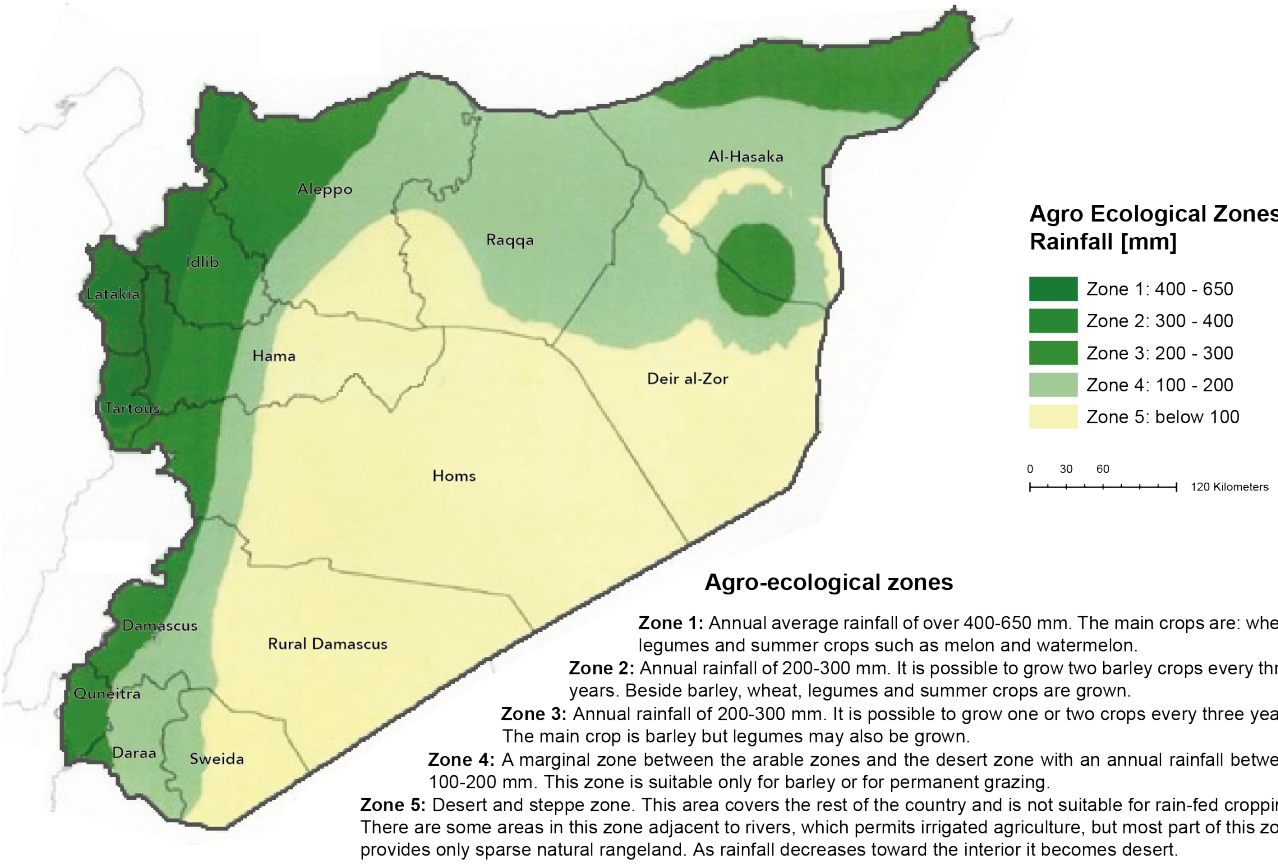
10 Kerina Tull, "Agriculture in Syria," *Knowledge, Evidence and Learning for Development*, 16 June 2017, https://bit.ly/3Kw3SUZ

11 Aula Abbaraa, Omar Zakieha and Diana Rayes, "Weaponizing Water as an Instrument of War in Syria: Impact on Diarrhoeal Disease in Idlib and Aleppo Governorates, 2011-2019," *International Journal of Infectious Diseases*, 108 (2021) 202–208, https://bit.ly/3KkZl7E

in August 2001. This was followed in June 2002 by an implementation document in which both states officially pledged to carry out common research projects and training programmes. In 2009, a Turkish-Syrian strategic cooperation council was established. Its role was to address joint activities in the field of water such as improving water quality, constructing water pumping stations and joint dams, and developing joint water policies.[12] However, even before 2011 the amount of water released was less than that agreed (500m3 a second), averaging less than 300 m3 a second as the Turkish authorities had constructed several dams upstream.

However, rain remained the main water resource in Syria. In 2008 the average annual amount of rainwater was estimated at 46 billion m3. This impacted the availability of all other water resources. The distribution of water stress in the region was very much connected to precipitation, which was unevenly spread across the country. Syria has been divided in five agro-ecological zones (AEZs) according to the level of annual precipitation received (Map 1 and Table 1). The coastal and mountain areas generally receive the most significant levels of rain. They are followed by the northern areas (Aleppo, Qamishli and Malkia in al-Hasaka), where atmospheric depressions coming from the Mediterranean Sea encounter mountains. On the other hand, in eastern, southern and desert places the precipitation is low.[13] In 2011 annual rainfall in Syria ranged from around 900 mm/year at the coast to about 60 mm/year in the east, while the evaporation rate was approximately 1300 mm/year in the west and 3000 mm/year in the eastern and south-eastern parts. More than 60% of the country received less than 250 mm/year in 2011, making Syria water scarce.[14]

Map 1: Agro-Ecological Zones (AEZs) in Syria



Agro-ecological zones

Zone 1: Annual average rainfall of over 400-650 mm. The main crops are: wheat, legumes and summer crops such as melon and watermelon.

Zone 2: Annual rainfall of 200-300 mm. It is possible to grow two barley crops every three years. Beside barley, wheat, legumes and summer crops are grown.

Zone 3: Annual rainfall of 200-300 mm. It is possible to grow one or two crops every three years. The main crop is barley but legumes may also be grown.

Zone 4: A marginal zone between the arable zones and the desert zone with an annual rainfall between 100-200 mm. This zone is suitable only for barley or for permanent grazing.

Zone 5: Desert and steppe zone. This area covers the rest of the country and is not suitable for rain-fed cropping. There are some areas in this zone adjacent to rivers, which permits irrigated agriculture, but most part of this zone provides only sparse natural rangeland. As rainfall decreases toward the interior it becomes desert.

Source: Food and Agriculture Organization of the United Nations, "Special Report: FAO/WFP Crop and Food Security Assessment Mission to the Syrian Arab Republic," 5 September 2019, https://bit.ly/3LFOd4N

12 In 1990, a Syrian-Iraqi water agreement was completed. It allocated water from the Euphrates River in fixed ratios of 42% to Syria and 58% to Iraq. Marwa Daoudy, "Asymmetric Power: Negotiating Water in the Euphrates and Tigris," *International Negotiation,* Issue 14, 2009, 361-391.

13 Ministry of Housing and Construction – The Syrian Arab Republic, "The Study on Sewerage System Development in the Syrian Arab Republic – Final Report," 2008, https://bit.ly/3GbDb63

14 Khaldoon A. Mourad and Ronny Berndtsson, "Syrian Water Resources Between the Present and the Future," *Air, Soil and Water Research, Sage Journal*, Volume 4, 2011, https://bit.ly/3MG1U57

Table 1: Precipitation recorded in the driest seasons from 1980 to 2021 by governorate (% of the annual LTA for each governorate)

	Al-Hasaka	Deir al-Zor	Raqqa	Aleppo	Idlib	Latakia	Tartous	Hama	Homs	Daraa	Sweida	Rural Damascus
1983/84	58	68	48	51	72	100	94	89	83	74	91	64
1985/86	106	106	131	75	97	102	83	97	70	73	78	54
1986/87	85	35	47	89	120	95	111	101	109	114	120	84
1988/89	70	59	85	57	70	79	61	70	65	101	80	71
1989/90	70	83	81	67	75	72	65	54	57	123	113	76
1991/92	236	65	89	82	60	120	122	109	154	156	164	127
1992/93	161	124	130	76	92	83	80	110	57	83	96	146
1993/94	97	105	83	60	98	93	92	70	66	70	96	96
1998/99	48	27	46	84	95	93	83	78	58	39	40	36
1999/00	44	52	46	77	83	93	84	79	64	56	72	59
2007/08	31	38	42	139	103	95	99	84	116	82	59	57
2008/09	56	59	59	96	103	97	96	91	128	103	95	71
2009/10	67	103	51	119	94	83	96	83	99	104	109	96
2010/11	72	77	55	100	114	97	143	98	105	105	91	137
2011/12	61	59	74	147	151	164	119	136	116	114	127	63
2013/14	71	85	102	49	39	48	37	65	62	75	79	85
2015/16	157	105	106	80	49	47	68	73	86	99	110	52
2020/21	59	51	58	68	64	82	115	79	96	98	78	99

Moderate Draught: Annual precipitation between 40-59% of the LTA **Severe Draught**: Annual precipitation below 40% of the LTA

Source: FAO, "Syrian Arab Republic Precipitation analysis 1980-2021," 2021, https://bit.ly/34J2KNH

1.2 State Institutions and Rising Concerns about Water Scarcity, Groundwater Contamination and Pollution

The management of water resources is the responsibility of several ministries, the main one of which is the Ministry of Water Resources, which was created in 2012 to replace the Ministry of Irrigation (Table 2). All these ministries operate within the Higher Water Council and are supported at the local level by various river basin management committees and drinking water companies in the Syrian governorates.[15]

Table 2 – Ministries in Charge of Managing Water Resources

Ministry	Responsibilities
Ministry of Water Resources	- managing Syria's water resources - distributing water resources to the domestic, industrial and agricultural sectors - controlling, expanding and securing water resources - drawing up relevant laws, policies and investment programmes - implementing drinkable water supply, wastewater collection and treatment services
Ministry of Agriculture and Agrarian Reform (MAAR)	- developing and reforming the agriculture sector
Ministry of Local Administration and Environment (MLAE)	- developing environmental policy and protection measures

Alongside these institutions in the field of WASH, the General Company for Bottling Water (GCBW) is a state company with a monopoly on bottling drinking water in the country through its control of Syria's four water bottling factories (the Boukein, Draykish, Ayn al-Fijeh and al-Sin factories), which currently produce 100% of bottled water. The private sector is forbidden from bottling water, although some is still imported and smuggled into the country. For several years the GCBW has sought to expand its production capacity to try to satisfy local needs. The volume of water it produces annually has been estimated at around 300 million litres since 2018.[16]

Water scarcity and worries about water pollution became a national concern in the 2000s. The decreasing availability of water was notably reflected in annual per capita water availability, which declined from 1,791 m3 in 1995 to 882 m3 in 2005.[17] In the decade before the war the Syrian government started to, at least rhetorically, show some interest in the issue of water scarcity and pollution, although without challenging its main dynamics.

In 2005, the Ministry of Irrigation promulgated Water Law No. 31, the objectives of which were to set irrigation fees, sanction farmers surpassing water consumption limits and modernise irrigation practices to bolster sustainability.[18] The law officially came into force in 2008, but it was never really implemented

15 Fanack Water, "Water Management in Syria," 22 March 2019, https://bit.ly/3wPzBKW

16 In 2019 the government allowed investments in various natural water springs, such as the al-Fawwar and al-Atm springs in Quneitra, the Nasiriyah spring in Homs and the Ayn Qenia spring in Sweida. Only investment in the al-Fawwar spring has started so far. The Syria Report, "Government to Establish New Water Bottling Plant in Quneitra," 18 January 2022, https://bit.ly/3IBPcSz

17 Emma Krampe, "Syria, Palestine and Jordan: Case Studies in Water Scarcity, Conflict and Migration," *Maneto Undergraduate Research Journal*, Vol.3 No.1, 2020, https://bit.ly/3GPHvrb

18 Farmers lacked sufficient modern equipment to prevent or reduce wastewater. Only 23% of the irrigated area in Syria was equipped with water-saving equipment in 2000, compared with around 70% in Tunisia. World Bank, "Agriculture in Syria: Towards the Social Market," June 2008, https://bit.ly/3GQ01Qk

and was completely abandoned with the outbreak of the conflict.[19] Similarly, a 2006 government plan to spend SYP 72 billion (equivalent to around USD 1.56 million in this period) to modernise irrigation infrastructure over a period of five years was never carried out.[20]

In addition, the Ministry of Housing and Construction engaged in an overarching plan to tackle problems related to the pollution of water sources with industrial and domestic waste, which was already a growing problem before 2011. The Ministry's programme contained a number of environmental regulations and an ambitious master plan to treat domestic wastewater throughout the country, including building between 320 and 345 centralised and decentralised treatment plants between 2010 and 2015. Half of these treatment plants were planned to be built in three governorates (Rural Damascus, Homs and Latakia) at a cost of SYP 90 billion SYP (equivalent to USD 1.9 billion in this period) funded by the Syrian state and supported by various foreign actors and institutions, and local private entities.[21] Realisation of this plan, with a total capacity of 1.2 billion m^3/day, would have served around 75% of the population, but it remained on paper.[22] Before 2011, 26 wastewater treatment plants (WWTPs) were in operation with a total capacity of 821,000 m^3/day. There were only four main centralised wastewater treatment plants in the major cities of Damascus, Hama, Homs and Aleppo, while the remaining 22 were decentralised with capacities ranging between 500 and 400 m^3/day (Table 3).

Table 3: Reuse of Treated Wastewater in Syria.

Governorate	Number of WWTPs	M^3 of treated water/day
Daraa	2	475
Homs	5	10,490
Hama	2	15,000
Aleppo	1	371,520
Latakia	4	2,100
Tartous	2	1,000
Raqqa	5	2,500
Al-Hasaka	1	5,000
Damascus and Rural Damascus	4	413,300
Total	26	821,385

Source: Fanack Water, "Water Resources in Syria," 23 July 2019, https://bit.ly/3wO2OFO

While officially 98% of the people in cities and 92% of those in rural communities had reliable access to safe water before 2011,[23] there were significant disparities in access to drinking water, for example between Damascus and the governorates in the northeast. There was a clear difference in per capita consumption between urban and rural areas: respectively 125 litres and below 80 litres a day. Similarly, around 89% of the urban population but only 69% of the rural population were connected to sewerage networks, and 71% of the urban population but only 7% of the rural population were connected to wastewater treatment plants.[24]

19 FAO, "Law No. 31 of 16 November 2005 on Water Legislation," 16 November 2005, https://bit.ly/340RlrO

20 Marwa Daoudy, *The Origin of the Syrian Conflict, Climate Change and Human Security,* Cambridge University Press, 2020, 133.

21 The Syria Report, "Syria to Invest USD 2 billion in Sewage Plants by 2015," 4 May 2011, https://bit.ly/3MDpcZl

22 Fanack Water, "Water Quality in Syria," 22 March 2019, https://bit.ly/3IVwGol

23 ICRC, "Syria Water Crisis: Up to 40% Less Drinking Water After 10 Years of War," 1 October 2021, https://bit.ly/3rxCv4a

24 Fanack Water, "Water Infrastructure in Syria," 22 March 2019, https://bit.ly/3KU2f3A

2. Destruction and Other Challenges in Wartime and Post-Conflict Syria

The outbreak of the conflict worsened the challenges already existing before 2011 and generated new ones with the destruction of water sanitation centres and infrastructure and widespread pollution of water. Turkey's control of water from the Euphrates River and restrictions of water flows imposed on areas in the northeast also created severe shortages and challenges in access to water by the local population. In addition, energy shortages constituted a serious obstacle in the management and supply of water, as did corruption but to a lesser extent.

2.1 Damage to Water-Supply Infrastructure and its Impact

Water supply infrastructure and systems were severely damaged or destroyed during the conflict by various actors. A United Nations investigation reported 46 attacks on water facilities in Syria in the year 2019 alone.[25] On various occasions in the past decades water sources were also deliberately contaminated, making the water unfit for consumption.[26] Alongside direct attacks, pumping stations, pipes and wells were often caught in crossfire and damaged during heavy bombardments. Extensive looting of infrastructure and materials also made water systems unusable. In addition, proper maintenance was often not carried out, and in some cases utilities lost approximately 40% of the technical staff and engineers needed to keep the systems operating. This resulted in promotion to higher posts of lower-level staff, who often lacked the necessary training. The organisation and management of water and sanitation infrastructure was therefore significantly impeded.[27] Consequently, at the end of 2021 50% of the water and sanitation systems across the country were not functioning, and millions of people lacked access to safe drinking water, the supply of which was around 40% less than a decade previously.

The destruction of WASH infrastructure also impacted the environment. For instance, the wastewater treatment plants serving Damascus and Aleppo cities have been inoperative since 2012 as a result of direct destruction. In the city of Deir al-Zor, approximately 40% of the sewage network was damaged resulting in a drop in access to water of around 40%. Similar levels of destruction were also witnessed in the city of Daraa.[28] At the national level at least 70% of sewage is discharged untreated and no less than half of the sewerage systems are out of order.[29] The beneficiaries of centralised wastewater treatment plants decreased from 13.5% in 2010 to 3% in 2019.[30] An absence or lack of water supply affects the daily functioning of state institutions, including schools and healthcare facilities. Water production dropped from 1,700 million m3/year in 2010 to 600 million m3/year in 2021, while the water share per capita per day in urban areas also diminished from 125 litres per day in 2010 to 60 in 2021 and in rural areas from 80 litres per day to 30.[31] The decrease in water production is most probably even higher as the size of the resident population has diminished since 2010.

25 UN General Assembly and Security Council, "Children and Armed Conflict: Report of the Secretary-General," 9 June 2020, https://bit.ly/3JyGoNy

26 For example, in 2017 Islamic State deliberately contaminated drinking water in governorates including Deir al-Zor, Raqqa and Aleppo to widen its domination of the population. At the same time, the Syrian regime cut water supplies to cities that were resisting its military sieges, for example to Homs between the end of 2011 and May 2014. Similarly, supplies to Aleppo were on various occasions cut off or destroyed by various actors – depending on which factions were about to capture the city or controlled part of it.

27 UNICEF, "Water under Fire," 2021, https://uni.cf/34Ek6vi

28 OCHA, "Syria: 2021 Humanitarian Needs Overview," March 2021, https://bit.ly/3gd826k

29 In addition, informal oil refineries known as 'burners' have multiplied since 2011 in the northeast, and the vast majority of them function with very low supervision and maintenance. OCHA, "Syria: 2022 Humanitarian Needs Overview," February 2022, https://bit.ly/3saWgQm

30 Official data from the Directorate of Services and Solid Waste in the Ministry of Local Administration and Environment.

31 These numbers are based on official data from the Ministry of Water Resources.

Similarly, the water from the Euphrates is not systematically filtered. Moreover, it is polluted as a consequence of damage to oil infrastructure in the northeast. For example, oil leaks from Gir Zero, a substantial storage facility in the Rmeilan oil field, have been occurring since at least 2014, with thousands of barrels of oil leaking out into creeks in the area and ending up in a 160km-long river.[32]

Alongside the Syrian government's lack of funds and interest in making the water sector a priority in its reconstruction policies, recovery of the WASH sector has also been affected by international sanctions. There are numerous obstacles against importing particular equipment and products because they are characterised as dual use items, such as chlorine products used for water purification and sanitation (but also for chemical weapons) and pumps, pipes and generators. A large number of local utilities producing chlorine products were affected (either destroyed or damaged) during the war and no plans to reconstruct them currently exist. UN agencies have only been engaged in restoring basic essential services in the sector, but not in reconstruction due to sanctions. In this context, WASH infrastructure products, spare parts and machines have increasingly been imported from Asia, particularly from China and India, instead of Europe. The infrastructure in the country therefore consists more and more of a hybrid of old equipment from Europe and new equipment from Asia, creating compatibility issues. Moreover, equipment from China and India is often of lower quality than that from Europe, and not provided with after-sales support and services, which are often critical for the operation of WASH infrastructure.[33]

2.2 Transborder Challenges, Electricity Shortages and Corruption

Other factors have contributed to shortcomings in the availability, supply and management of water resources. First, transborder water flows to Syria have been affected. For instance, since January 2021 water flows from the Euphrates River from Turkey into Syria have been significantly lower than average, resulting in dangerously low water levels in downstream reservoirs in Syria. This is connected to political decisions in Turkey and its hostile stance regarding the Autonomous Administration of North and East Syria (AANES). This demonstrates the powerful role of Turkey as Syria's upstream neighbour, which is having clear consequences in terms of water access in Syria.[34]

In mid-June 2021 the water flow dropped to 214m3/second compared to an average of more than 2,000 m3/second during the 'flooding months.'[35] This was less than half the volume needed to guarantee the normal functioning of dams and just over a meter above their dead level. By the end of 2021 at least a third of the over 200 water stations along the Euphrates River continued to be considerably impacted by low water levels, which affected the water supply to an estimated 5.5 million people across the region. This situation contributed to a decline in electricity produced by the Tishrin and Tabqa dams, which are the main sources of electricity for an estimated three million people. Against the background of pervasive fuel and electricity shortages, this new loss of electricity has further exacerbated the functioning of critical water pumping stations along the Euphrates River, including the use of more power-intensive submersible water pumps.[36] Reductions and repetitive cuts in supply from the Alouk water station have severely affected access to safe drinking water for approximately 460,000 individuals in and near the al-Hasaka governorate.[37]

32 PAX for Peace has estimated that between 2012 and 2016 nearly 5,800 makeshift refineries were constructed. Wim Zwijnenburg, "Scorched Earth and Charred Lives," *PAX for Peace*, August 2016, https://bit.ly/3sUO5XV

33 Skype interview with an anonymous individual active in the field of WASH in Syria, March 2022.

34 Marwa Daoudy, "Asymmetric Power: Negotiating Water in the Euphrates and Tigris," *International Negotiation,* 14, 2009, 361-391.

35 OCHA, "Water Crisis in Northern and Northeast Syria; Immediate Response and Funding Requirements," 9 September 2021, https://bit.ly/3GQS7WY

36 OCHA, "Water Crisis in Northern and Northeast Syria."

37 OCHA, "Syria: 2022 Humanitarian Needs Overview," February 2022, https://bit.ly/3saWgQm

Second, the supply of water has also been significantly impacted by destruction of and damage to the electricity system in the country.[38] In a context in which the power generation capacity has diminished by 60% to 70%, access to water is jeopardised.[39] For example, numerous cities and regions are lacking water supply because of the long hours of electricity cuts and rationing, and the equipment at most wells, which are dependent on electricity, is also damaged. Power rationing can reach up to 20 hours a day in some regime-held areas due to a lack of fuel oil and gas to run the power plants. The vast majority of the population are incapable of dealing with network shortages as alternatives, such as solar- and fuel-powered generators, are beyond most people's purchasing power. Similar dynamics exist in the northeast. In the northwest the supply of electricity is relatively better as a result of two factors: various local and international organisations have funded programmes to restore power generation capacity, notably by establishing sustainable-renewable energy systems;[40] and electricity is mostly sourced from Turkey through the Syrian-Turkish Energy (STE Energy) and Green Energy companies.[41] However, prices have significantly increased since the beginning of 2022 as a result of depreciation of the Turkish lira, which has led to small protests by the local population, particularly in the cities of Jindires and Afrin in northern Aleppo.[42]

Finally, corruption plays a role in preventing better functioning of the water service in various areas. In the governorate of Sweida, for instance, nine wells are out of service at the al-Thaala plant. Sweida, the main city in the governorate, has been receiving only a quarter of its daily needs (3,000 m3 instead of 12,000m3), as have the other towns and villages in the governorate. Officials attribute the endless breakdowns to electricity shortages, the high cost of repairing faulty wells, poor financial liquidity and an inability to import particular spare parts as a result of sanctions.[43] While these factors are true to some extent, a network of corrupt personalities connected to the director of the Water Corporation have been working to maintain some of these problems due to the benefits they accumulate by winning state tenders to repair damaged infrastructure and machines and to provide the spare parts needed.[44] Similarly, in the governorate of Latakia, the results of an investigation published in December 2021 estimated that of an average rate of 41,000 m3 a day of water loss, around 23% of the total amount of water pumped in the governorate, between 16% and 18% of this loss was stolen, mostly by individuals with connections to security officials. These personalities piped drinking water to their farms to fill swimming pools and water their farms and private orchards, while cities such as Jableh faced regular water shortages for periods as long as two weeks.[45]

38 Sinan Hatahet and Karam Shaar, "Syria's Electricity Sector After a Decade of War: A Comprehensive Assessment," Florence: European University Institute, Middle East Directions, Wartime and Post-Conflict in Syria, Research Paper, 30 July 2021, https://bit.ly/3ivWP2a

39 ICRC, "Syria Water Crisis: Up to 40% Less Drinking Water After 10 Years of War," 1 October 2021, https://bit.ly/3rxCv4a

40 For instance, in November 2020 the Syria Recovery Trust Fund launched projects called the 'Sustainable Energy Solar System for Water Pumping Stations in Rural Areas of North Aleppo – Phase I' and 'Rehabilitation of Water and Sanitation Infrastructure in a District North of Aleppo – Phase I,' both of which have budgets of EUR 1.8 million. The former aimed to reinstate power generation capacity in the countryside of northern Aleppo by installing sustainable-renewable energy systems. This electricity project is planned to positively impact 165,000 beneficiaries, in addition to 85,000 indirect beneficiaries. Syria Recovery Trust Fund, "Sustainable Energy Solar System for Water Pumping Stations in Rural Areas of North Aleppo – Phase I," 24 November 2020, https://bit.ly/3OfoPEM

41 STE Energy is a Turkish company that manages the electricity sector in Turkish-occupied areas through its offices in Rural Aleppo. It is the mother company of AK Energy, a company that has supplied electricity to areas in Aleppo under the control of the Turkish-backed Syrian Interim Government since April 2018. Since May 2021 Green Energy has had a monopoly on the electricity sector in Idlib, controlled by Hay'at Tahrir Sham. The Syria Report, "New Electricity Price Hikes in North and Northwest Syria Escalate Protests," 11 January 2022, https://bit.ly/3PlmNi6

42 Farhat Ahmad and Wissam Salim, "Syria: One Dead and One Wounded in Shooting at Protesters Against Electricity Companies in the Countryside of Aleppo," (in Arabic), *al-Araby*, 4 June 2022, https://bit.ly/397HSSw

43 Suwayda 24, "Sweida: The Water Crisis is Worsening, and the Future is Worse" (in Arabic), 25 December 2021, https://bit.ly/3HtLNoC

44 Phone interview with researcher Mazen Ezzi, 3 March 2022.

45 Al-Hussein Masoud, "Latakia is Thirsty: Water Lines Subject to Puncture and Theft; Powerful People Above the Law," *Enab Baladi*, 21 December 2021, https://bit.ly/3aa2vh7

3. The Impacts on Agriculture and the Population

In 2019 Syria's annual water needs, including for agricultural, industrial and domestic use, were estimated at about 12.9 billion m3, with agriculture consuming between 86% and 89%.[46] Water scarcity and pollution are having negative impacts on agricultural and food production and on livestock rearing. At the same time, water supply has increasingly become a source of concern for Syrians as result of the spread of diseases, and also constitutes a rising cost.

3.1 Devastated Agriculture; Suffering Peasants and Farmers

The war and its consequences resulted in the destruction of irrigation structures and pumping stations, which alongside recurrent erratic electricity outages and rising fuel prices,[47] triggered a substantial reduction in the areas under irrigation. The irrigated area for industrial crops, such as cotton and sugar beet, which necessitate processing factories, many of which were damaged or destroyed, also decreased dramatically.[48] Nevertheless, with the restoration of irrigation infrastructure there have been modest improvements in recent years in the area of irrigable land, which passed from 1.42 million hectares in 2019/20 to 1.44 million hectares in 2020/21.[49] Irrigation is primarily used for wheat, vegetables, cotton, potatoes, sugar beet and citrus fruit.[50] The agriculture sector today remains highly dependent on irrigation because of irregular rainfalls, particularly in the northern governorates of the country: al-Hasaka, Aleppo and Raqqa, and Deir al-Zor along the Euphrates.

The large number of irrigation canals destroyed has led farmers and peasants to over-exploit even more groundwater and build new unregistered ones. The increase in the use of groundwater wells, in addition to lowering the water table, has increased the salinity of the water, which as a result has lowered yields.[51] In addition, farmers in the northeast have lost entire crop fields as seasonal rains have flooded the polluted canals, creeks and rivers, disseminating fuel oil over thousands of hectares of land.[52]

In this context, damaged irrigation infrastructure, scarce rainfall, the lack of fuel and the increasing cost of production have reduced the production of cotton, wheat and fruit (apples, cherries, apricots, citrus fruit, etc.). For instance, the amount of citrus fruit production decreased by 27.3% between 2016 and 2021. This reduction resulted from a failure to secure the required quantities of irrigation water to grow and develop the fruit, in addition to a decline in dam stock, according to Director of the Citrus Office at the Ministry of Agriculture, Engineer Suhail Hamad.[53] The effects of climate change have also had a clear impact on agricultural production in general and on citrus fruit in particular, as a consequence of longer periods of drought. As was previously mentioned, most Syrian cereal cultivation is rainfed and is therefore sensitive to weather shocks and climate volatility.[54] Similarly, wheat production in 2022

46 This percentage is probably lower because of the significant increase in the price of fuel and the general decline in the water supply. FAO, "Special Report. FAO Crop and Food Supply Assessment Mission to the Syrian Arab Republic," 27 December 2021, https://bit.ly/3IvQnTz

47 Before 2011, around 75% of the groundwater pumps, well rigs and equipment for drilling and deepening wells were powered by diesel motors.

48 Already before the war intensive cultivation of cotton and sugar beet accompanied partly by unsuitable land management led to soil deterioration especially in the north of al-Ghab in the Hama governorate. The resulting decline in yields reduced farm income.

49 FAO, "Special Report. FAO Crop and Food Supply Assessment Mission," 25.

50 Francesca De Chatel, "The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution," *Middle Eastern Studies*, Volume 50, Issue 4, 2014.

51 Increased salinity has been reported in Deir al-Zor, al-Hasaka and parts of the coastal governorates. FAO, Special Report. FAO Crop and Food Supply Assessment Mission" 27.

52 Wim Zwijnenburg and Yifang Shi, "A River of Death," *PAX for Peace*, June 2020, https://bit.ly/35gIMtH

53 Al-Watan Online, "786,000 Tons Citrus Production Estimates for this Season," 1 September 2021, https://bit.ly/3KxAFsR

54 60% of the land planted with wheat and at least 90% of the land planted with barley are rainfed. FAO, "Syrian Arab Republic, Precipitation analysis 1980-2021," 2021, https://bit.ly/34J2KNH

has been estimated at a very low level, approximately 1.05 million tonnes as in 2021, compared to 2.8 million in 2020 and a pre-crisis average of 4.1 million tonnes (between 2002 and 2011),[55] while the need in regime-held areas is around 3 million tonnes.[56] Lastly, cotton production has also suffered a harsh reduction, from 472,000 tonnes in 2010 to 72,000 tonnes in 2022,[57] which has pushed the government to authorise cotton imports since July 2021. This commodity represents the backbone of the country's textile industry.

Farmers with difficult access to irrigation water have increasingly been dependent on purchasing water in tankers, which is, however, difficult to provide in certain areas and very expensive (see below). The lack of water resources and the rise in the general cost of production (especially for fuel oil and fertilisers) have pushed some farmers to cease their activity and leave their lands for other livelihood opportunities,[58] while others have accumulated high levels of debts or seek a second job to cover their agricultural expenses. The cost of cultivating a dunum passed from between SYP 10,000 and 30,000 (equivalent to between USD 4 and 12) at the beginning of 2022 to around SYP 700,000 (equivalent to USD 249) in May.[59]

Water scarcity and pollution have also affected the health and quantity of livestock in the country,[60] together with other reasons such as smuggling, population displacement, a lack of animal feed and a reduction in veterinary services The number of sheep, for instance, has diminished by around 30%, from 18 million in 2010 to less than 15 million in 2020. In 2021 water access for animals was restricted in various areas of Hama, al-Hasaka, the Syrian desert (al-Badia) and in Deir al-Zor, which witnessed shrinking river water levels. This situation resulted in higher water pollution levels and a proliferation of insects and germs that triggered diseases among animals.[61]

Water rainfall and reserves are continual growing problems for Syrian agriculture. The impact of climate change on Syria will increase in the next years with more recurrent and intense severe weather events and shifting temperatures and precipitation patterns. In this context, farmers have used various strategies to try to cope with water scarcity. For instance, there has been a progressive switch by some farmers in certain areas from irrigation and intensive farming to rainfed subsistence farming, while others have transformed their cropping systems to cultivating rainfed barley and wheat instead of vegetables such as peas, potatoes and cabbages, which need to be irrigated all year.[62]

3.2 Diseases and New Financial Burdens for Syrians

The continual degradation and damage in water treatment networks have increased the proportion of Syrians depending on often unsafe alternatives to piped water, which reached 47% in 2022 from 38% in the previous year. Wastewater has been discharged untreated into the natural environment resulting in serious risks to public health and significantly contaminating groundwater resources. In this context, water pollution and tankers selling unlicensed water (around 1,000 litres generally) have resulted in the dissemination of numerous diseases such as leishmaniasis in Aleppo and Deir al-Zor and typhoid fever around Damascus.[63]

55 FAO, "Special Report. FAO Crop and Food Supply Assessment Mission."

56 Ramz Mahfouz, "The Government Considers its Prices are Covering Agriculture Costs. The Farmer Has Another Say" (in Arabic), *al-Watan,* 12 May 2022, https://bit.ly/37J7SCT

57 Hana Ghanem, "The Government Sets the Price of a Kilo of Cotton at 4,000 Pounds," (in Arabic), *al-Watan*, 21 June 2022, https://bit.ly/3OD3Bkn

58 In Rural Damascus, for instance, subsidised diesel covered about a third of total fuel needs for pumping in 2021. In this context, many farmers decreased the areas they irrigated to reduce their losses as production costs increased. FAO, "Special Report. FAO Crop and Food Supply Assessment Mission," 28.

59 Hanna Ghanem, "Statements to Advance the Agricultural Sector are Bright but Unrealistic," (in Arabic), *al-Watan,* 9 May 2022, https://bit.ly/3Ld8Dlt

60 A lack of water consumption decreases animal performance as water makes up around 60-70% of a live animal's weight.

61 FAO, "Special Report. FAO Crop and Food Supply Assessment Mission,"

62 Telephone interview with an anonymous expert active in the field of Agriculture in Syria, May 2022.

63 Fanack Water, "Water Quality in Syria."

The level of use of unsafe alternatives to piped water is higher in northern Syria, with rates exceeding more than 50% of the population, and over 70% of IDPs residing in camps.[64] The concentration of wastewater in the Euphrates River has increased and has led to epidemics affecting three governorates through which the river flows.[65] The number of cases of acute diarrhoea increased, for instance, by 54% in the al-Hasaka governorate in the first six months of 2021 compared to the same period in 2020.[66] Similarly, in the city of Raqqa the number of diarrhoea cases in May 2021 was 50% higher than in May 2020.[67] Diarrhoea can further expose the population to malnutrition, which is especially risky as the high cost of food has already resulted in unprecedented high rates of food insecurity throughout the country.

Generally, regions with a frequent lack or absence of water have witnessed the development of water-borne diseases. Malaria has recently put additional strain on a public health system already debilitated by years of war and sanctions and overburdened by the COVID-19 pandemic. The lack of clean water has generated a situation fertile for the propagation of communicable diseases, including polio, hepatitis A, impetigo, scabies and diarrheal diseases.[68]

Restricted access to safe water has similarly impeded hygiene and other preventative measures, such as handwashing, necessary to curb the proliferation of the COVID-19 pandemic. Around 15.5 million Syrians lacked access to adequate water and sanitation services at the end of 2019 according to UNICEF.[69] The scarcity and shortages of safe water are disproportionally affecting women's and girl's reproductive health and threaten to escalate maternal morbidity and mortality. As a consequence of water scarcity, shared bathrooms in camps also increase the risks of sexual harassment, assault, rape and kidnapping.

Provision by state institutions and private actors of water in trucks is far from enough to secure drinking water for the population. At the same time, the increase in the cost of production and the scarcity of water have resulted in a rise in the price of water in state institutions, and also on the market. The General Company for Bottling Water (GCBW) has increased the price of bottled water several times since March 2021. The latest rise occurred in the end of June 2022. Its director, Bassam Ali, explained it by the increasing operational costs and prices of raw materials, alongside the difficulty of securing the imports of some of these items and the decisions of the Ministry of Electricity to raise the price of electricity.[70] On the market, the cost of bottled water has reached three to five times its official price. In north-eastern Syria, the price of drinking water has surged dramatically, reaching SYP 6,000 (equivalent to 2.4 USD) for a litre in the city of al-Hasaka, instead of the official price of SYP 1,000.

Since September 2021, individuals have been allowed to use smart cards to purchase limited quantities of water: two large packs of water equivalent to six 1.5 litre bottles every two weeks at a price of SYP 3,150 SYP (USD 1.2 at the official exchange rate of 2,814 SYP/USD since April 2022) each and one small pack (equivalent to twelve 1-litre bottles) every two weeks at a price of SYP 4,200 (USD 1.5) each.[71] These quantities are, however, not enough to meet monthly needs.

64 OCHA, "Syria: 2022 Humanitarian Needs Overview."

65 Delil Souleiman and Alic Hackman, "Drought and Geopolitics Threaten Syrian Residents of the Euphrates" (in French), *Orient le Jour and AFP*, 31 August 2021, https://bit.ly/35kTXBB

66 OCHA, "Syria: Alouk Water Station, Flash Update: Disruption to Alouk Water Station," July 2021, https://bit.ly/3rJtDIM

67 Doctors Without Borders, "Millions of Vulnerable People are Facing an Acute Water Crisis in Northern Syria," 27 September 2021, https://bit.ly/34PXVC6

68 Aula Abbaraa et al. "Weaponizing Water as An Instrument of War in Syria: Impact on Diarrhoeal Disease in Idlib and Aleppo governorates, 2011-2019," *International Journal of Infectious Diseases*, 108 (2021) 202-208, https://bit.ly/3KkZl7E

69 UNICEF, "Water under Fire."

70 Haytham Yahya Muhammad, "Thursday… Increase in Industry "Water" Prices," (in Arabic), *al-Watan*, 26 June 2022, https://bit.ly/3OJ4JDa

71 The Syria Report, "Government to Establish New Water Bottling Plant in Quneitra," 18 January 2022, https://bit.ly/3IBPcSz

In January 2022 the Ministry of Industry decided to stop selling water to private distributors. In this decision it was stipulated that the government would sell 70% of its production of bottled water through institutions affiliated with the Syrian Trade Establishment (STE) and 30% through the Social Military Establishment (SME), which is affiliated to the Ministry of Defence. Previously, private actors had been marketing 70% of the state-produced bottled water and the STE and the SME 20% and 10% respectively.[72] This did not prevent a new price increase in the following weeks. The government had already decided in September 2021 to only market its bottled water through state entities. However, a few weeks later without providing any reasons it once again enabled private actors to operate in the market. The reality was that even during this short period, deliveries of water to various private actors by the STE continued, while state institutions were accused of being unable to supply sufficient quantities throughout the country, creating water shortages in various areas.

The provision of water to houses for household needs (such as washing) continued to be complicated because of the lack of electricity and the destruction of infrastructure.[73] Some towns and neighbourhoods went more than two weeks without any water, leading them to purchase water from private actors. This increasingly led to a rising cost of water, which was an additional financial burden for families suffering from low incomes. These dynamics exist in different parts of the country, but most particularly in the peripheries of the main cities, small and medium-sized towns and rural areas. In certain towns and areas lacking water for long periods in February 2022 the cost of water provided by tankers had reached between SYP 20,000 and 30,000 (USD 7.96-11.94) for an amount generally equivalent to five barrels (around 1,000 litres), instead of SYP 10,000-15,000 (USD 3.98-5.97) previously.[74] The cost was affected by fuel price rises and a reduction in subsidies in this period. On average, a family of five needs to refill its tank at least three to four times a month, leading to a total monthly cost ranging between SYP 60,000 and SYP 120,000 (USD 21.3-42.6).[75] The high cost of trucking water in the northeast has resulted in households being prevented from accessing enough water, which according to humanitarian data provider REACH constituted "a barrier in 46% of the communities assessed."[76]

This more generally reflects the increase in the average cost of living due to rises in the prices of goods, which are impacting the whole population.[77] The national average medium expenditure basket (MEB) – which is defined as the cost of meeting essential needs for a five-member household – underwent an increase of 22% between January and March 2022, from SYP 611,386 (USD 245) to SYP 746,418 (USD 299).[78]

Selling water distributed by tankers is therefore a profitable market, most probably controlled by networks of businessmen connected to the regime.[79] In this context, the businessmen involved in this lucrative market and their patrons in power have no interest in rapidly reconstructing the water supply infrastructure and resolving the issue of water scarcity in various areas under the control of Damascus.

72 Al-Watan, "A Difficult Equation that Industry and Supply Are Unable to Solve!" (in Arabic), 16 January 2022, https://bit.ly/32vrO9U

73 Due to the lack of rationed electricity hours, water only reaches the ground floors of buildings and families which have a generator to operate a water pump, thus depriving other residents of access to water.

74 In February 2022, the cost of a five-barrel tank of water reached SYP 40,000 (USD 15.92) in most neighbourhoods of the city of Jaramana because of water shortages. In contrast, in the Adra Damascus Industrial City, industrial manufacturers generally purchased the same volume for about 16,500 SYP (USD 6.6) in the same period because the area was better supplied (Telephone Interview with an employee of an industrial company in Adra Damascus Industrial City, February 2022).

75 The number of times a tank is refilled in a month mostly depends on the level of family income. Phone interview with an individual from Latakia, January 2022.

76 REACH, "Briefing Note: Humanitarian Impact of Water Shortages in Northeast Syria," *Relief Web*, April 2022, https://bit.ly/3w7F2Vb

77 Joseph Daher, "Hellish Cycle Continues for Syria: The Economic Impacts of Russia's Invasion of Ukraine," *Middle East Directions Blog*, 28 March 2022, https://bit.ly/3NTAHfV

78 WFP, "Syria Country Office, Market Price Watch Bulletin March 2022 Issue 88," March 2022, https://bit.ly/3MZf3pW

79 The monopoly on water products sold by private actors amounts to about 90% according to opposition media Syria TV. Syria TV, "The Government of the Syrian Regime is Unable to Solve the Problem of Mineral Water" (in Arabic), 16 January 2022, https://bit.ly/3rdqO3v

Conclusion

Water scarcity and pollution are presenting a significant challenge for recovery – primarily in agricultural food production and to a lesser extent in other sectors, including manufacturing –and for improving the living conditions of the population. This comes alongside other factors such as shortages and high prices of energy (fuel oil and electricity). The damage and destruction inflicted on water infrastructure and supply and desalinisation systems have significantly impacted large sectors of society, with various diseases connected to the lack of water. In addition, water has increasingly become an additional expense for families, which have to cope with rising prices of basic commodities.

The impacts of climate change will exacerbate problems relating to water scarcity and pollution, resulting in a further reduction of renewable water resources, an increasing frequency of droughts because of decreasing rainfall, increasing domestic and agricultural demand for water as temperatures continue to rise, and growing seawater infiltration in coastal aquifers as sea levels increase and groundwater over-exploitation persists.[80] At the same time, the conflict has led to additional predicaments and new challenges, including more pollution, internal displacement and migration causing higher pressure on cities and suburbs for drinking water, and environmental problems such as deforestation.

In this context, initiatives and policies could be carried out to improve the water supply and access to it in the short and medium term, such as enhancing the management of water resources, irrigation conveyance systems and agricultural watering techniques. It is absolutely necessary to favour cultivation which requires less water. Similarly, measures to alleviate sanctions which prevent the import and restoration of WASH infrastructure should be a priority. Many more structural responses must be rooted in the country's political economy and the economic model of agricultural production, which is the sector consuming most water resources, especially in a potential post war situation. The progressive adoption of a neoliberal model of agricultural production in recent decades based on intensive industrial export-led agriculture and concentrated on the most profitable crops such as fruit and vegetables, in Syria and elsewhere in the MENA region, has negatively impacted on subsistence agriculture. Continual austerity measures have also contributed to the detriment of the sector. Small scale farmers and other types of food producers have seen their material capabilities and their ability to produce weakened.[81] This agricultural model has been centred principally on an extractive logic based on maximisation of value extraction from nature without taking into account the need to regenerate resources, resulting in significant environmental predicaments such as water scarcity and pollution. A shift away from this mode of production is needed towards one emphasising the right of food producers to dignified living and working conditions, and favouring local and regional markets over international ones, while including ecological solutions regulating the relation between farmers and peasants on the one hand and natural resources on the other to guarantee sustainable development of the sector.

80 UNDP, "Water Governance in the Arab Region Managing Scarcity and Securing the Future," 2013, https://bit.ly/33EwNFA

81 Joseph Daher, "The Political Economic Context of Syria's Reconstruction: A Prospective in Light of a Legacy of Unequal Development," Research Project Report, (Florence: European University Institute, Middle East Directions, Wartime and Post-Conflict in Syria, December 2018) https://bit.ly/3gKebq3

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