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What constitutes an equitable water share? A reassessment of equitable apportionment in the Jordan–Israel water agreement 25 years later

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Abstract

The water agreement between Jordan and Israel, created as part of their peace treaty in 1994, set out detailed allocations terms to which both countries have respectively abided since its inception. But after two and a half decades, the water agreement terms no longer appear as equitable considering the social, economic, and environmental changes that have occurred in the region as a whole and within the two countries individually. This paper analyzes the status of the treaty terms in light of changes seen within both countries regarding the factors laid out by the United Nations as relevant to determining equitable apportionment among riparian nations. The analysis suggests that a renegotiation of the water agreement terms is warranted due in large part to changes in population and the availability of alternative water resources (desalination and treated wastewater). While no explicit recommendations are made as to what a future treaty's terms should include, this paper presents evidence of a changing ground reality that deserves greater consideration in reaching a more equitable and sustainable water agreement for the decades to come.

Keywords: Equitable apportionment; Israel; Israel–Jordan peace treaty; Jordan; Jordan river; Transboundary; Water agreement; Water annex; Water management

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Introduction

The concept of dividing watercourses fairly has historical precedent, given rise to the doctrine of 'equitable apportionment' in national and international case law, and found sophisticated expression in flexible bilateral and multilateral treaties and agreements. These experiences suggest guidelines and legal parameters for countries currently seeking to resolve their disputes. Israel and Jordan's experience is one that can learn from such precedents.

Ancient societies understood that the geographic unity of river basins required cooperation between users (Teclaff, 1967: p. 5). Thus, stone tablets record water compacts between Mesopotamian city states (Oppenheim, 1964: p. 284) and Herodotus reports that Persian kings apportioned river flow according to need (Herodotus, 1928 trans., Bk. III, p. 88). Roman law considered water use to be property, but no owner could infringe on others' rights or impair navigation (Justinian, §§ 43.20.3, 43.12.2, 1985 trans.). Based on Roman legal principles, Spanish colonial law in the New World elaborated various factors for the adjudication of water disputes: just title, prior appropriation, need, injury to third parties, legal right, and the common good (Meyer, 1984: pp. 145–167).

Modern principles of water sharing began developing in the 19th century as technological advances and industrialization led to increased non-navigational uses of waterways. A spectrum of theories arose ranging from 'absolute territorial sovereignty,' frequently referred to as the Harmon Doctrine after its most noteworthy advocate, to 'absolute territorial integrity.' The former claiming a state's complete right to water within its territorial borders and the latter, restricting any water use that could affect riparian states.

International treaties and guidelines in the 20th century gained nuance and further codified principles for the management of transboundary watercourses. The Helsinki Rules in 1966, the 1992 Helsinki Convention promulgated by the Economic Commission for Europe, the United Nations Convention on the Law of Non-Navigational Uses of International Watercourses in 1997 and the Berlin Rules in 2004 all support fundamental tenets that counsel 'reasonable' and 'equitable' division of international watercourses. That 'reasonable' and 'equitable' use should be determined by a number of factors related to the geographic and hydrologic characteristics of the basin, the economic and social needs of the riparian states, the populations of the states, the existing and potential uses of the watercourse, the availability of alternatives to the watercourse, the effects of the use and development of the watercourse by one state on another, the protection of the watercourse, and the costs of the development of the watercourse (UN Watercourses Convention, 1997; Beaumont, 2000; Kaya, 2003).

Between the Helsinki Rules in 1966 and the United Nations Convention in 1997, increased environmental awareness led to the development of a 'do no harm' principle, codified by the 1997 convention. As such, environmental considerations were added to the United Nations Convention and the Berlin Rules to supplement previously listed relevant factors. Regardless of specific factors, the above conventions all advocate for a holistic approach to 'equitable' and 'reasonable' apportionment, leaving the significance afforded each factor and additional 'relevant factors' dependent on the individual basin. The holistic nature of these guidelines leaves substantial room for debate. Beaumont (2000) has termed the UN Convention an 'impressionistic set of rules,' with Wolf (1997) claiming that these rules 'provide little practical guidelines for allocations' (pp. 333–334). Others (Benvenisti, 1996; Leb, 2012; Vink, 2014) have questioned the meaning of ambiguous phrases within international guidelines, such as 'optimal utilization,' 'beneficial use,' 'sustainable development,' and 'vital human needs.' What are the most optimal, beneficial, and sustainable ways in which to use a watercourse and what constitutes the most vital of human needs? Even 'equitable use' is lacking in definition, with some (Dellapenna, 2001; Woodhouse & Zeitoun, 2008; Rahaman, 2012) positing that it was not intended to mean 'equal use.'

In attempting to better define equitable allocation rules, there are precedents set in the US and other countries regarding cases resolving interstate claims to shared rivers. US Supreme Court justice Oliver Wendell Holmes, Jr. explained that separate states' rights should be balanced because a river 'offers a necessity of life that must be rationed among those who have power over it' (*New Jersey* v. *New York*, 1931). The test for allocating use was 'substantial interest.' For example, while Kansas could not prevent Colorado's upstream diversion absent proof of injury (*Kansas* v. *Colorado*, 1907), New Jersey could enjoin New York from diminishing a river's flow and consequently increasing salinity and harming its oyster industry (*New Jersey* v. *New York*, 1931). However, a state could not protect its own water quality by imposing higher environmental standards than those of the federal government; thus Oklahoma could not prevent Arkansas from discharging waste into a river so long as the national protections were not violated (*Arkansas* v. *Oklahoma*, 1992). This US limit on equitable apportionment contrasts with the stricter Canadian approach: Manitoba was authorized to use its higher provincial standards to block pollutants discharged into its waters by Ontario and Saskatchewan (*Interprovincial Co-ops* v. *The Queen*, 1975). Germany and Italy have also used the doctrine to protect the environment of individual states, despite the consequent impact on other states' sovereignty (Kaya, 2003: pp. 53–54).

International tribunals' judgments have applied equitable apportionment as well, attempting to prevent any one nation from monopolizing a disproportionate amount of a watercourse's flow. In the 1929 Oder River case, the Permanent Court of International Justice determined that a commission set up under the Versailles Treaty had jurisdiction to guarantee navigational and non-navigational uses to countries sharing a tributary (*River Oder Case*, 1929). The Court declared that

> the community of interest in a navigable river becomes the basis of a common legal right, the essential features of which are the perfect equality of all riparian States in the [use] of the whole course of the river and the exclusion of any preferential privilege of any one riparian State in relation to the others

The same tribunal decided eight years later that the Netherlands could not cut off the flow of the Meuse River to Belgium by constructing a barrage (*Diversion of Water from the Meuse*, 1937). Refining the duty owed by one nation to another, an arbitral commission held in 1957 that France as an upper riparian had a good faith obligation to consider the effect of a hydroelectric project on a downstream country, Spain (*Lake Lannoux Arbitration*, 1957).

Apart from the issue of equitable apportionment, others see a danger in unwavering devotion to initial terms. Kilgour & Dinar (2001) find it unsurprising that in treaties that contain strict water allocation terms that rely on a projected static water supply, the agreement lasts 'only until the first drought' (p. 45). Draper & Kundell (2007) similarly lament that many water agreements rely solely on the historical flow records, leaving little room to adjust when flows change in the future. And Kistin & Ashton (2008) see that there is little consideration in water treaties for variations in annual flow, extreme climatic events, climate change, demographic changes, and population growth.

To see how countries can amend agreement terms that are no longer viable, Mexico's and the United States' allocation of shared rivers provides direction. By a 1906 convention the United States as the upper riparian guaranteed 60,000 acre-feet of water per year to Mexico, based on the goal of an 'equitable distribution of … the Rio Grande for irrigation purposes' (Convention between the United States and Mexico …, 1906). In 1944, this delivery arrangement was expanded by treaty, apportioning 1.5 million acre-feet of the Colorado River to Mexico yearly (Treaty Between the United States and Mexico …, 1944). This allocation, however, was based on unusually high flow measurements during the preceding years, and so did not account for the multiple agricultural, business, and urban demands to which the river would be put (Reich, 2013; German-Soto, 2014).

The problem was partially addressed by the International Boundary and Water Commission, a binational agency authorized to manage water distribution, which developed a system of 'minutes,' or ad hoc adjustments, to respond to changing conditions (Reich, 2013; German-Soto, 2014). For example, Minute 319 provided that Mexico would accept a reduced amount when reservoirs were low while the United States would increase deliveries at times of high supply (IBWC Minute 242, 1973; IBWC Minute 319, 2012; Buono & Eckstein, 2014). The Mexico–US experience shows that equitable apportionment may be implemented through a treaty's authorization of adjustments by a binational body. This kind of arrangement has been seen elsewhere, as in the agreement between Botswana, Lesotho, Namibia, and South Africa on the Orange-Senqu River that allows for future modifications in the case of drought conditions and sets protocols for making future amendments (Kistin & Ashton, 2008).

The above review of guidelines and specific cases addressing equitable apportionment, as well as the means by which nations can continue to tweak initial agreements, offers precedents to follow in grappling with water agreements between other nations. This paper seeks to provide incisive analysis of the Peace Treaty between Jordan and Israel, learning from and utilizing well-established principles of equitable apportionment. After over 25 years, the ground reality has changed on both sides of the border to a considerable degree. We herein argue that the terms agreed to in 1994 can no longer be considered equitable and a reformulation of water allocations and management should be made.

The following provides a review of the Jordan–Israel water agreement and the debate surrounding its terms, including previous attempts to reformulate water allocations. We then address the need for a readjustment in the agreement by accounting for the social, economic, and environmental changes that have occurred within each country. By taking into account these changes, a more equitable water division can be realized for a sustainable and just future. We do not address to what extent the 1994 water annex was 'good' or 'bad' or who benefited most; rather, the case is made for why and on what basis a new agreement could be formulated.

The Jordan–Israel water annex

The Jordan River originates from Jabal Al Shaikh (known also as Mount Hermon) and receives additional flow from the Hasbani River in the south of Lebanon, the Banias River in the occupied Golan Heights and the Dan River in Israel. After reaching Lake Tiberias (also known as the Sea of Galilee or the Kinneret), its flow is joined by the Yarmouk River, which serves as the border between Jordan and Syria, before continuing south and emptying into the Dead Sea (shown in Figure 1). The total length of the Jordan River and its tributaries is roughly 228 km and runs through Lebanon, Syria, Israel, Palestine, and Jordan. Today, mainly due to exploitation and diversions, only 20–30 million cubic metres (MCM) of water reach the Dead Sea each year, compared to the historical 1,300 MCM that used to flow into the Dead Sea. This represents a 97% reduction in the river's flow and has contributed to a 50% decrease in its biodiversity since the 1930s (Gafny *et al.*, 2010).

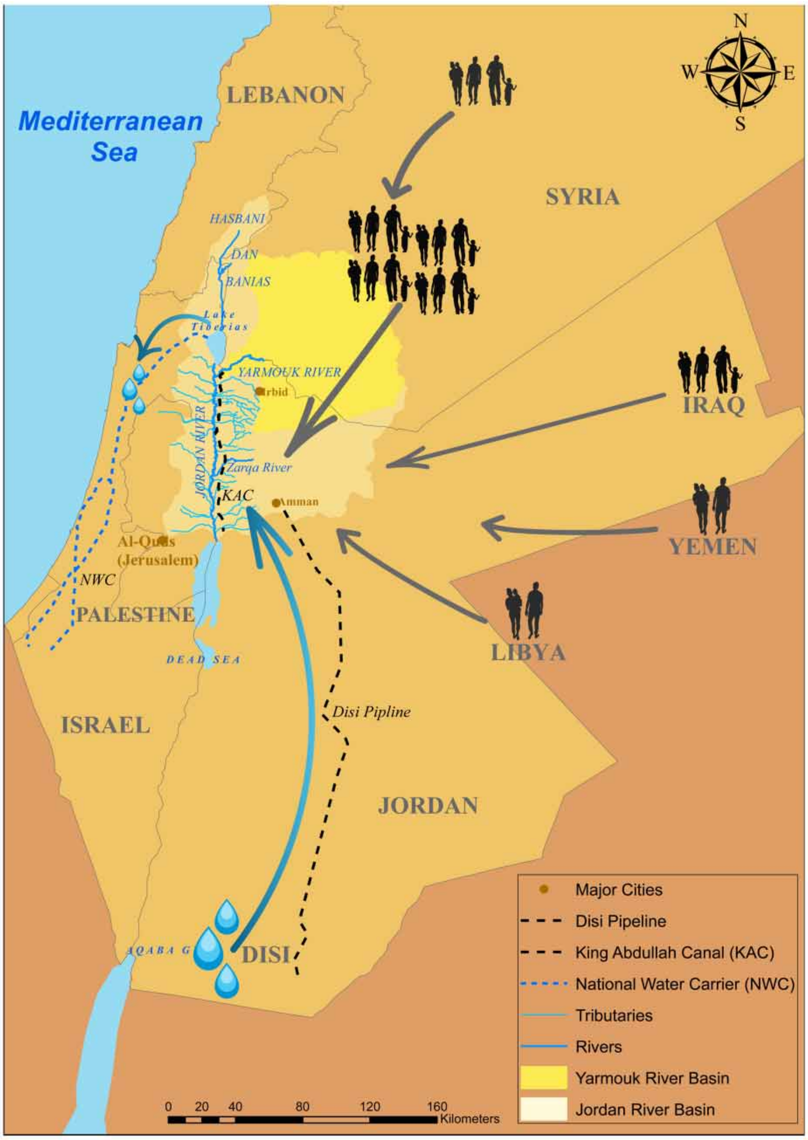

Fig. 1. Overview of water resources and infrastructure in Jordan and Israel with diagram showing the flow of water and refugees into/out of the Jordan River Basin, discussed further in the *Population* and *Current and potential utilization of Yarmouk and Jordan River waters* sections.

In the Treaty of Peace between the State of Israel and the Hashemite Kingdom of Jordan in 1994, Annex II refers to water-related matters (herein referred to as the water annex) and outlines how both parties will divide the waters within the Jordan River Basin and conduct joint water management. Several general overviews exist of these terms of the water annex as well as brief historical backgrounds of the conflict over shared water resources between Israel and Jordan that led to the 1994 agreement (Elmusa, 1995; Fathallah, 1996; Beaumont, 1997; Haddadin & Shamir, 2003; Wiczyk, 2003).

Fifty years prior to ratification of the water annex, experts attempted to formulate a water agreement between Israel and its neighbors. The most notable proposal, the Johnston or Unified Plan, was never officially signed but became the de facto situation after garnering tepid support from all riparian states. The plan was presented in 1955, prior to most modern international conventions on equitable water sharing, and relied entirely on a single factor: irrigable land area within the Jordan River Basin. The rationale for such a simplistic formula held that agriculture was essential for societies in the basin and the primary consumer of water. Once allocations were made, each country was granted self-determination of water usage and distribution, permitting out-of-basin transfers (Elmusa, 1995). This precedent created the current, inefficient system whereby Israel removes water from the basin to supply population centers along the Mediterranean coast while Jordan pumps water into the basin from as far away as the Disi aquifer.

Over time, the Johnston Plan allocations also lost practical relevancy as water use in the basin shifted from agriculture to domestic and Israel became increasingly hydro-hegemonic. At the time the plan was created, water was primarily used for irrigation, although by 2015, domestic water use accounted for 46% of Jordan's water budget and 42% of Israel's (IWA, 2015b; MWI, 2015). Trends in agricultural water use have increasingly shifted towards the use of recycled wastewater, diminishing the need for fresh water resources in the sector. Israel also began to exceed the Johnston Plan allocations after occupying the Golan Heights and establishing a more strategic position within the basin. Despite advances in international understanding of transboundary waterway divisions and changing water use in society, the water annex proved the lasting symbolic significance of the Johnston Plan by restoring Jordan's allocations nearly to those historically set for the East Bank (Beaumont, 1997; Hof, 1998).

The exact terms of water division in the water annex govern the shared water resources of the Yarmouk River, the Jordan River, and the Wadi Araba/Arava groundwater resources. Israel can pump 12 MCM per year of water from the Yarmouk River in the summer and 13 MCM per year of water in the winter, with Jordan retaining the remainder of the flow in both seasons. Israel's fixed allocation provides a constant water supply while Jordan's fluctuates year to year, proving risky in times of drought. In addition, Jordan concedes to Israel the pumping of another 20 MCM per year from the Yarmouk River in the winter in return for allowing Jordan to transfer in the summer 20 MCM per year of water from the Jordan River below the point where the Yarmouk River joins the Jordan River. This is also known by water practitioners as Jordanian 'storage' in Lake Tiberias. Jordan is to receive 10 MCM per year of desalinated water from the treatment of saline springs that Israel diverts to the Jordan River but before desalination is operational, Jordan should receive the 10 MCM of water from the Jordan River below the point where it meets with the Yarmouk River. In practice, there is not enough water in the river at this location so water is released from Lake Tiberias by Israel and pumped through pipes directly to Jordan to fulfill this amount[1].

The water annex in Article 1, section 3 mandates that both parties find an additional 50 MCM per year of water up to drinkable standards for Jordan, omitting any indication of which party should bear the costs of this provision. The ambiguity of this provision allowed the Treaty to be ratified by both countries domestically but led to a 'mini-crisis' when disagreements over the source and financing of the additional 50 MCM persisted (Fischhendler, 2008). In the end, Israel agreed to supply Jordan

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[1] It is still referred to as the 'desalinated water.'

with 25 MCM per year of water for three years, until a desalinization plant could be built. In practice, Jordan continues to receive 25 MCM per year, as opposed to its full allocation of 50 MCM[2].

Other terms in the water annex require both sides to build water storage facilities on their shared watercourses, take measures to protect the quality of surface and groundwater resources, grant prior notification to the other party in the case of any new project to be conducted on the shared watercourses, agree to exchange relevant water data, and set up a Joint Water Committee (JWC) to guide future management of the watercourses.

Regarding groundwater usage, the Peace Treaty returned sovereignty of Wadi Araba to Jordan, an area that had previously been occupied illegally, but allowed Israel to continue to pump up to 10 MCM per year of water from wells drilled on the Jordanian side of Wadi Araba. The Water Annex established a 'de facto' water exchange whereby Israel would sell water to Jordan in the north, to maintain use of water in Wadi Araba (Elmusa, 1995). However, Jordan purchases the water in the north while Israel 'leases' wells in the Wadi Araba without paying, establishing a unique and inherently uneven exchange.

Uri Shamir and Munther Haddadin, prominent Israeli and Jordanian (respectively) members of the negotiation teams, have praised the agreement for its longevity and continued implementation as signs of its merits and worth despite, as Haddadin (2011) states, 'the cold relations that have dominated the political scene between Israel and Jordan since 1999' (p. 182). Indeed, despite the drought of 1998–1999, while tensions mounted, the JWC was able to lay-out temporary terms for both sides that modified their water allocations (Odom & Wolf, 2011). Furthermore, they respond to criticism of the water annex terms by stressing the larger picture and importance of the treaty. As Shamir (2003) underlines: 'What it [the treaty] accomplishes for each side in the area of water should be viewed in light of the total treaty, not in isolation' (p. 15).

Others note that the agreement is in-line with broader international principles for shared watercourse management (Fathallah, 1996; Kliot & Shmueli, 1998; Wiczyk, 2003), with the phrase 'rightful allocation,' as noted by Fathallah (1996), 'intended to implicitly apply the equity doctrine' (p. 143). Some also state that the agreement gives due attention to principles of cooperation and joint regional management, seen in part in the establishment of the JWC, and recognizes the legal rights of both parties to the shared water resources while safeguarding them against 'significant harm' (Fathallah, 1996; Kliot & Shmueli, 1998; Wiczyk, 2003).

Many take issue, though, with the specific quantitative water allocations that were granted to Israel and Jordan. While Elmusa (1995) and Borthwick (2003) suggest that Jordan's water allocation position was improved with the water annex, Beaumont (1997) and Hof (1998) stress that Jordan was awarded less water in the 1994 agreement as compared to the amount allotted to Jordan in the Johnston Plan of 1955 that was accepted, although never ratified, by Israel and the Arab League. Some express concern that Jordan's allotted water amount from the Yarmouk River is not a set quantity in the current water agreement but rather a residual and therefore subject to change from year to year (Elmusa, 1995; Beaumont, 1997; Shamir, 2003; Odom & Wolf, 2011). According to Jordan's Ministry of Water and Irrigation's (MWI) annual water budgets for 2005 to 2015, the amount of water diverted to Jordan from the Yarmouk River has varied from as little as 9.55 MCM per year to 60.12 MCM per year, depending on rainfall, how much water Syria takes from the Yarmouk River, and the amount of water allotted to Israel from the Yarmouk River.

[2] This water is referred to as the 'additional water.'

Yet others contest the undefined and unidentified extra 50 MCM per year that should be found for Jordan. Beaumont (1997) sees this situation as a result of Israel being the party that has more fully developed the water resources whereas Jordan was not. This asymmetry in positioning can be placed within the wider scope of literature addressing hydro-hegemony and critical hydropolitics as the main drivers of transboundary water management (Zeitoun & Warner, 2006; Zeitoun, 2008). Israel is the 'hydro-hegemon by being located upstream, having more power in the form of material resources and bargaining ability, and generating an international norm that sees it as legitimately superior in stature' (Zeitoun, 2008). The hydro-hegemon can shape allocations and more easily maintain its superior position in the basin through the use of agreements and treaties that become its tools to legitimate potentially unfair distributions between itself and co-riparians (Zeitoun & Warner, 2006; Woodhouse & Zeitoun, 2008).

Attention to water quality has also been lacking. Fathallah (1996) observes a failure to address the 'do no harm' principle, especially with regard to the saline waters and groundwater usage, and Wiczyk (2003) finds little to provide long-term plans for the protection of joint water courses. Talozi *et al*. (submitted) show that the water quality of the Jordan River has deteriorated steadily since the signing of the peace treaty, due in large part to both sides accelerating their diversion schemes after the treaty. To Israel's credit, in 2013, it began pumping water from Lake Tiberias into the lower Jordan River to aid in its rehabilitation. Israeli newspapers reported at the time that Israel would start by pumping 1,000 m^3 of water per hour from the lake into the river, with the ultimate goal of pumping 30 MCM of water per year into the river (Udasin, 2013).

The evolution of the UN convention factors for equitable division from 1994 to 2015

Concrete suggestions exist for equitably allocating resources among riparian countries, increasing the specificity of international conventions. Beaumont (2000) uses a simple formula of dividing the water into two categories, the amount produced within each country and the amount of water historically used in each country, and allocating water to each riparian based on these categories. Seyam *et al*. (2000) propose using an algorithm that yields a water allocation between riparian countries based on inputs such as the amount of green and blue water resources[3], the population counts, and the river positions of each country. Similarly, Van der Zaag *et al*. (2002) divide waters according to the proportion of each country's area within the river basin, population size, and green and blue water resources. Kilgour & Dinar (2001) opt for determining allocations based on a rule that considers flow variations in light of each country's water demands, contribution to the flow, and river position. And Lankford (2013) allocates water among riparian countries based on seven criteria within each country: area within the basin, runoff in the basin, population, GDP, GDP growth, a measure of poverty, and current water use, weighting each according to input from discussions with riparian stakeholders.

In considering a re-evaluation of the Jordan–Israel water annex, Fathallah (1996) supports the inclusion of factors related to the geography, ecology, socioeconomic needs, population, existing and potential use, and potential alternatives supplies, rather than giving precedence to natural characteristics and prior use. Mimi & Sawalhi (2003) also suggest a more inclusive 'decision tool,' as will be employed

[3] Green water is rainfall and the evapotranspiration of this rainfall from plants; blue water is fresh surface or ground waters.

in this paper, to highlight the changes that have occurred over the past two and a half decades. The objective is not to offer newly calculated quantities that should be allotted to both parties to the agreement but rather to discuss and consider the changing circumstances that warrant both countries taking actions to bring about a fairer and more just agreement for the long term.

To adjudicate consistently, this analysis will rely on factors outlined in the Helsinki Rules, then reiterated in the UN Watercourse Convention, and the Berlin Rules, thus applying legal concepts to real-world factors. Given advances in modern conventions on water sharing and evolving water uses, these factors hold more relevancy to current water sharing than antiquated allotments determined by irrigable land.

The factors that have evolved and will be discussed are the following:

- The geography and hydrology of the river basin.
- The populations of each state that depends on the waters within the basin.
- The climatic conditions that have affected the basin.
- The past and present utilization by both parties of the waters of the basin.
- The economic and social needs of each state.
- The availability of other water resources.
- The availability and costs of alternative ways of satisfying the economic and social needs of each state.

Geography and hydrology

Israel has a total area of 21,640 km^2 with 3,033 km^2 within the Jordan River Basin, while Jordan's total area is 88,780 km^2 and 7,183 km^2 is within the basin (Comair *et al.*, 2012). The within-basin areas for Israel and Jordan represent 17% and 40% of the total basin area, respectively. Average rainfall within Israel's catchment area in the basin is 1,328 MCM per year and its average evapotranspiration is 858 MCM per year, while Jordan's average within-basin rainfall is 1,911 MCM per year with an average evapotranspiration of 1,695 MCM per year (Comair *et al.*, 2012). According to Comair *et al.* (2012), the average amount of available surface water in Israel's portion of the basin's catchment area is 470 MCM per year and that of Jordan's is 216 MCM per year, representing 48% and 22%, respectively, of the entire available water in the Jordan River Basin (Lebanon, Syria, and Palestine supply the remaining water).

While surface waters account for only 35% of the water resources in the basin, groundwater resources comprise 56% of these resources, with treated wastewater and non-conventional water resources accounting for 9% of the water resources (Frenken, 2009). No data have been found that record the precise groundwater contributions from the Israeli and Jordanian sides of the basin so this remains a point that warrants further investigation.

Changes in the hydrology to flows of involved rivers also have an impact. The construction of the Unity Dam between Syria and Jordan on the Yarmouk River allowed for Jordan to have more storage capacity on the river. The dam did affect flow but did not affect Israel's share of the Yarmouk River waters because the dam, while planned in the 1970s, was only built after Israel was guaranteed its share of the river waters. On the other hand, Israel's unilateral construction of the National Water Carrier has had negative consequences for the availability of water resources for downstream riparian countries.

Overall, Jordan has a bigger total area within the basin (more than double that of Israel) but precipitation on the Jordanian side is lower due to an arid climate and it experiences a high evapotranspiration rate. Thus, the amount of available water in Jordan appears to be lower than the amount in Israel, although this conclusion remains incomplete without more data on groundwater resources.

Population

According to World Bank world development indicators, Jordan's population in 1994 was 4,061,000 and Israel's population was 5,399,000. During the period between 1994 and 2015, the population growth rate in Jordan and Israel diverged dramatically with Jordan's increasing from 2.6 to 7.9 and Israel's declining modestly from 2.6 to 1.9. As shown in Table 1, Israel's estimated 2015 population is 7,822,000 (United Nations, 2015) and Jordan's population in 2015 is reported as 9,559,000 (Jordan Department of Statistics (DoS), 2015).

The number of Jordanians within the total population is 6,613,587 (69% of the total), while the number of non-Jordanians is around 2,918,125 and includes Syrians, Egyptians, Iraqis, Yemenis, Libyans, and other nationalities (DoS, 2015). Around half, or 1.3 million, of those non-Jordanians residing in Jordan are Syrians, 656,198 of whom are registered refugees as of August 2016 (UNHCR, 2016b). The number of Palestinian refugees (and their non-Palestinian dependents) in Jordan as a result of the Syrian crisis was 15,686 in 2014 (UNRWA, 2015). There are an additional 57,727 refugees in Jordan from Iraq, Somali, Yemen, Sudan, and other nationalities (UNHCR, 2015).

Among all non-Jordanians, around 89% live in governorates in the northwest region of the country, namely, Amman, Zarqa, Irbid, and Mafriq, that have an impact on the Jordan River watershed (DoS, 2015). The largest Syrian refugee camp in Zaatari is located in Mafraq, again within the watershed, and a large user of groundwater resources. The daily share of water per refugee has been reported as 40 liters (Namrouqa, 2015) and according to Jordan's Ministry of Water and Irrigation (2013), each refugee costs the water sector around 500 Jordanian dinar per year. As a result of the conflict in Syria, the number of internally displaced people in Syria, within governorates that tap into the Jordan River Basin's watershed area, namely, Dar'a, As-Sweida, and Quneitra, amounted to 266,000, 69,000 and 72,000, respectively, in 2014 (IDMC, 2014).

Table 1. Population breakdown by immigration status in Jordan and Israel.

	Official population	Refugees	Asylum seekers	Other foreign residents
Jordan	9,559,000[a]	656,198 registered Syrians[b] 15,686 registered Palestinians[d] 57,727 registered others[e]	10,466	1,652,611[c]
Israel	7,822,000[f]	38,500 registered	6,591[g]	287,900[h]

[a]According to the Department of Statistics, Jordanian Government (2015).
[b]1.3 million Syrians in total in Jordan.
[c]Non-Jordanian/non-Syrian residents (Egyptians, Palestinians, Iraqis, Yemenis, Libyans and others).
[d]Palestinian refugees from Syria and their non-Palestinian dependents.
[e]Iraqi, Somali, Sudanese and Yemeni refugees.
[f]According to the World Statistics Pocketbook, UN Department of Economic and Social Affairs (2015).
[g]Potentially as high as 46,437 according to the African Refugee Development Center website.
[h]Includes foreign workers and Palestinian workers from Palestine (West Bank) as of 2011.

Israel hosts a share of refugees as well, albeit to a lesser extent than Jordan. There are 38,500 refugees in Israel and 6,591 asylum seekers as of June 2015 (UNHCR, 2016a). The African Refugee Development Center's website records the number of solely African asylum seekers in Israel as 46,437, with most originating from Eritrea and Sudan.

Foreign laborers in both Jordan and Israel also add to their populations. In Jordan, while exact numbers are not available, the 2015 census records the number of non-Jordanians (other than Syrians) residing in Jordan and it can be assumed that many are within the foreign labor population. According to the census, 636,270 Egyptians, 634,182 Palestinians, 130,911 Iraqis, 31,163 Yemenis, 22,700 Libyans, and 197,385 of other nationalities reside in Jordan. In Israel, the number of non-Palestinian foreign workers was 51,600 in 1994 and rose to about 250,000 in 2018 (Neuman, 2011; Amit, 2018).

Due to the recent conflict in Syria, Jordan is experiencing a larger and more concentrated pressure from an increasing population. Figure 2 shows the populations in Jordan and Israel from the time of the Johnston Plan (1955) through 2020 (projected). Jordan experienced a particularly dramatic increase between 2005 and 2018, surpassing Israel in 2011 (UN, 2015). Moreover, the increase in population in Jordan – including refugees and foreign workers – has occurred largely in the Jordanian territories within the Jordan River Basin. In Israel, on the other hand, the increase in population has taken place mainly in the coastal cities outside of the basin.

Climate and climate change

Changes have occurred in the climatic conditions of the Jordan River Basin, particularly with regard to rainfall and temperature. Black (2009) finds a significant decrease in the amount of precipitation in Jordan and Israel in the winter months of November, December, and January. Rahman *et al.* (2015) also

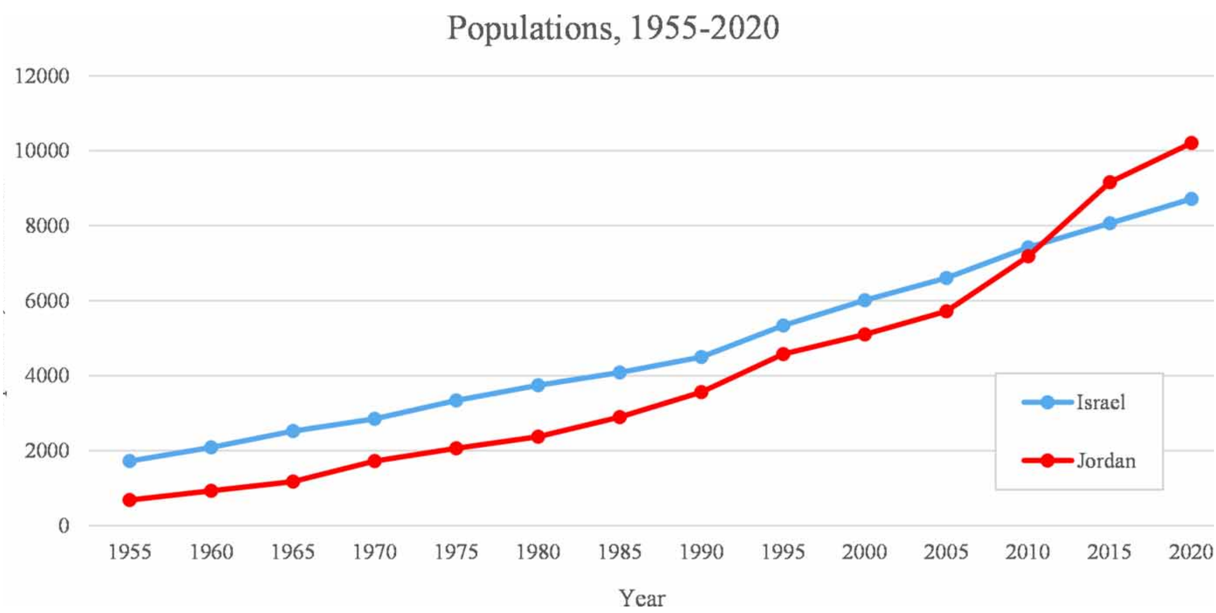

Fig. 2. Populations of Jordan and Israel from 1955 to 2020 (projected). [a]UN World Population Prospects, 2017.

show an overall decreasing trend in rainfall in Jordan, in particular in the drought years of 1995–2013, and Smiatek *et al*. (2014) expect that rainfall amounts will continue to decrease in the area of the Jordan River. Matouq *et al*. (2013) report that the mean annual maximum temperatures in Jordan, on the whole, are increasing and Smiatek *et al*. (2014) forecast rising temperatures in the 21st century in the upper portion of the Jordan River Basin. Israel's Second National Communication on Climate Change (Israel Ministry of Environmental Protection, 2010) and Jordan's Third National Communication on Climate Change (Jordan Ministry of Environment, 2014) both report that temperatures are expected to increase throughout the 21st century in comparison to the latter half of the 20th century, accompanied by an increase in extreme temperature events and a decrease in precipitation.

In comparing between Jordan and Israel, Siebert *et al*. (2014) report that the mean annual precipitation on the western portion of the Jordan Valley (Israel–Palestine) is greater than on the eastern portion (Jordan). They also find that surface runoff is three times larger in the east than in the west, indicating that Jordan's groundwater resources are being replenished at a much lower rate and that there is therefore less water available on the Jordanian side. While both Israel and Jordan are experiencing the negative effects of climate change, there are some hints that Jordan is affected to a greater extent, especially in terms of rainfall and water retention.

Current and potential utilization of Yarmouk and Jordan River waters

Israel's existing utilization of the waters in the Jordan River Basin is between 580 and 640 MCM per year and Jordan's is about 290 MCM per year (UN-ESCWA, 2013). Israel takes advantage of the Jordan River by way of the National Water Carrier (NWC) that was completed in 1964 to carry water from Lake Tiberias to areas outside of the basin (shown in Figure 1), primarily for drinking water purposes today. According to the website of Israel's national water company, Mekorot, the NWC is about 130 km in length and pumps water up over 300 m along its course, supplying roughly 380 MCM per year of water in a year with average rainfall. However, the Israeli government and, in particular, Energy Minister Yuval Steinitz decided recently to build additional desalination plants in the Western Galilee and in Sorek, intending to pump part of the desalinized water into the lake and to decrease the reliance on pumping water from Lake Tiberias via the NWC for the years to come, also as an answer to the receding coastline of the lake. In fact, the shrinking of the lake would mean 'increased acidity [that] could cause ecological problems, including making it problematic to pump water out' in the future (Schindler, 2018). This, in practice, would mean that the Israeli use of Jordan River water would be limited to the basin itself, in contrast to the situation since the completion of the NWC in 1964.

Jordan exploits the Jordan River through the King Abdullah Canal (KAC), completed between the 1960s and 1980s, that runs for 110 km along the length of the Jordanian side of the Jordan Valley although remaining in the Jordan River Basin. According to the MWI's 2013 Water Budget, about 80 MCM of water per year was diverted into the KAC from the Yarmouk River and from a pipeline transferring water from Lake Tiberias. Some of the water is used for agriculture in the north of the Jordan Valley and the rest is pumped up over 1,000 m to the Zai Water Treatment Plant for drinking purposes in Amman, both locations within the Jordan River Basin.

In sum, Israel uses a larger portion of the basin's surface waters outside of the basin while Jordan is relegated to a smaller portion of the waters and uses all of it within basin. Moreover, Jordan has to pump water from outside of the basin, from the Disi aquifer in the far south of the country, to cities within the basin to meet its rising domestic needs within the basin. Referring back to Figure 1, this creates a system whereby Israel takes water out of the basin while Jordan pumps water in to meet the demand of increased refugee populations within the basin. This pumping of water out of the basin by Israel and into the basin in Jordan is inherently inefficient and environmentally irresponsible. At the same time, Israel's dependence on the basin's waters has and is likely to continue to decline as it develops alternative water resources through desalination and treated wastewater (as discussed below).

Economic and social needs

The question here arises of what constitutes the optimal or necessary uses of water, especially in terms of vital human needs. Chenoweth (2011) estimates that the minimum amount of water per capita for domestic needs and economic activities, allowing for 10% losses in the distribution system, would be 135 L per capita per day, or 50 m^3 per capita per day. According to World Bank development indicators, neither Israel nor Jordan measure up to this minimum per capita requirement. In 2014, Israel's annual per capita share of water resources was 91 m^3 and Jordan's was 77 m^3 (World Bank).

As shown in Table 2 (which counts both freshwater and recycled water), in Israel, total water demand stands at 2,187 MCM per year in 2013, with 138 MCM per year for industry (7%), 733 MCM per year for domestic use (34%), 1,205 MCM per year for agriculture (55%), 54 MCM per year for the West Bank (2%), 4 MCM per year for Gaza (less than 1%) and 53 MCM per year for Jordan (2%) (Israel Water Authority (IWA, 2015b). In Jordan, total water demand was 1,213 MCM per year in year 2013 although total water use was around 902 MCM per year, with 39 MCM per year for industry (4%), 381 MCM per year for domestic uses (42%), 475 MCM per year for agriculture (53%), and 7 MCM per year for other uses (1%) (MWI, 2013)[4].

Agriculture is the most prominent consumer of water in both countries, a potentially irrational situation in light of their arid climate and agriculture's minimal contribution to GDP and labor force participation rates. In Israel, agricultural production accounted for about 2.3% of the country's GDP in 2015 and 2% of its exported goods and services (Shalem-Cohen & Dizahav, 2013; MoE, 2016), with 2% of the entire labor force working in the agricultural sector (Israel Export & International Cooperation Institute, 2012). The agricultural sector in Jordan contributed 2.9% to the country's GDP in 2011, with agricultural exports constituting of 14% of Jordan's total domestic exports. The segment of the labor force involved in the agricultural sector in Jordan is 5% (Al-Karablieh, 2012).

As Al-Karablieh (2012) notes, the low percentage of the agricultural sector's contribution to Jordan's overall GDP actually rises to 29% when downstream activities are included. This is likely the case in Israel as well, where agriculture not only comprises those efforts by farmers but also of those involved in the inputs, machinery, packaging, water provision, transport, and trade of the agricultural produce. Al-Karablieh mentions and Talozi *et al*. (2015) re-emphasize that the agricultural sector is a large provider of affordable fruits and vegetables for the Jordanian people and provides incomes for those who are able to export the goods. In addition, agriculture in Jordan is seen as a strategic rural development factor (Al-Karablieh *et al*., 2012).

[4] It is not known whether the 10 MCM of water that Israel pumps from the Wadi Araba aquifer as per the water annex is taken into account in either country's official budgets.

Table 2. Water sector usage data (MCM) for 2013 in Jordan and Israel.

	Water sector usage (MCM per year) in 2013				
	Domestic use	Agriculture	Industry	Other	Total
Israel	733	1,205	138	111*	2,187
Jordan	381	475	39	7**	902

*Water allotments to the West Bank, Gaza and Jordan.
**For livestock.

Ide & Fröhlich (2015), with regard to Israel, state that water and agriculture are deeply embedded in its identity as a Jewish state rooted in pioneers who farm and are self-sufficient. Fishelson (1994) posits that agriculture has positive effects on the environment and Tagar (2007) notes that giving water to the agricultural sector is a way to support the value of nature, protect species and their habitats, improve air quality and reduce noise, and also absorb urban waste in the form of treated wastewater (as addressed later). Fishelson (1994) also suggests that agriculture is something attractive to tourists and Tagar (2007) adds that agriculture can protect 'the visual character of the country,' moderating the building-up of urban areas.

When assessing the social and economic needs for water in Jordan and Israel, the domestic sector is a default necessity. But as has been argued, so is agriculture. Both Israel and Jordan's needs for water in the agricultural sector have to be respected and accounted for in future water negotiations.

Alternative water resources

Another factor to consider is what types of alternative means both countries have developed to provide additional water supplies or better manage the current supply. The cost of additional or alternative resources and means for providing adequate supplies of water is also of import considering that some development avenues are not within the grasp of all parties at present.

A significant alternative source of water that Israel has developed is the desalination of seawater. Five desalination plants were completed along Israel's coastline from 2005 to 2018 with a total capacity of over 600 MCM per year of desalinated water: Ashkelon – 120 MCM per year; Palmachim – 90 MCM per year; Hadera – 145 MCM per year; Sorek – 150 MCM per year; and Ashdod – 100 MCM per year (Mekorot website). These desalination facilities were costly, though. According to the website of Water Technology, the Ashkelon plant cost roughly $212 million, the Ashdod plant $163 million, and the Sorek plant $400 million. Israel has built many smaller desalination facilities to desalinate brackish water from ground wells, with a current production of 50 MCM per year (IWA, 2015c) and hopeful future production of 80–90 MCM per year by 2020 (Tenne, 2010). As noted by Feitelson & Rosenthal (2012), the advances in desalination in Israel may also have an impact on transboundary water governance in the Israeli–Palestinian context.

Jordan, on the other hand, has not been able to engage in the desalination of seawater, due mostly to the high expense. As seen in Israel, plants that produce 100–150 MCM per year can cost anywhere from $163 million to $400 million. While Israel's GDP in 2013 was roughly $290 billion with a GDP/capita of $36,000, Jordan's GDP in 2013 was only around $34 billion and its per capita GDP $5,000 (World Bank world development indicators). Jordan has been able to construct smaller brackish water desalination plants but they are limited in their use, mainly for industrial or commercial enterprises or for individual farmers (Mohsen, 2007).

Beyond cost, some suggest that desalination is impractical for Jordan because of the country's limited shoreline area, the need to transport the water from the shoreline to major population centers over considerable elevation that would require steep pumping costs, and Jordan's lack of energy resources to provide the pumping costs and thus its further reliance and dependence on energy imports (Keyzer *et al*., 2004; Mohsen, 2007). The main urban areas and water demand in Jordan are located in the northern governorates, while the shoreline available for a desalination plant is on the Red Sea in Aqaba about 300 km away. In comparison, Israel has a shoreline of about 270 km and most of its major urban areas are along the shoreline.

Israel, Jordan, and the Palestinian Authority did sign an agreement in December 2013 to construct a desalination plant in Aqaba that would provide desalinated water to Jordan, of which Jordan would sell 50 MCM per year to Israel and Israel would, in turn, sell the same amount of freshwater to Jordan from Lake Tiberias (Namrouqa, 2013). Israel would also sell to the Palestinian Authority 30 MCM from new sources of water (Al-Jazeera America, 2013; Hussein, 2017).

Another key alternative resource is treated wastewater (TWW). Israel has wastewater treatment plants spread throughout the country that produce around 400 MCM per year of reclaimed water. Of the 505 MCM per year of wastewater that is produced in Israel, 95% of it is treated and 85% of the TWW is reused (IWA, 2015a). In Jordan, 40% of the wastewater generated (around 304 MCM/year in 2013) is currently collected and treated, resulting in 122 MCM/year of TWW in 2013 (MWI, 2013). Of this amount, 96% is reused in restricted agriculture, or mixed with rainwater for subsequent use on crops in the Jordan Valley. The most prominent plant is the Khirbat as-Samra Wastewater Treatment Plant but there are also 30 other smaller treatment plants in Jordan. As with desalination plants, TWW facilities are not cheap either. Khirbat as-Samra was constructed at a cost of $169 million and its latest expansion in July 2015 cost roughly $192 million (Water Technology website; MWI, 2014). Additionally, the MWI (2016) recently released a capital investment plan which outlines $2,700 million worth of wastewater projects between 2016 and 2025, tracking to cover 85% of the population with wastewater treatment services by 2035. Israel has spent roughly $750 million since 2000 on wastewater treatment plants (IWA, 2015a).

While desalinated seawater and TWW are 'humanly produced' and essentially 'industrial' products, not natural resources, they can still be considered alongside freshwater resources, as argued by Feitelson (2012). Freshwater that is provided to the municipal sector is also treated to a certain extent and conveyed over various distances away from its original source, making it not purely 'natural' either. Rather than strictly distinguishing between freshwater and the other alternatives, Feitelson (2012) simply urges a distinction between how they are used. The use of TWW has for the time being been limited to the agricultural sector due to societal and cultural concerns for its use in the municipal sector.

Compared to 1994, Israel is now less dependent on the Jordan River because of desalination and TWW while Jordan continues to use the entirety of its limited quantity of water available from the Jordan River. Considering that much of the population residing in the basin still needs the river's waters for their livelihoods, Israel's lesser dependence could be made to benefit other riparian populations in the future.

Management methods

Management strategies to better conserve existing water resources are equally considered of import. One problematic issue is non-revenue water (NRW), or water that is lost in distribution systems before reaching end consumers. In 2010, according to Baghdali *et al*. (2013), NRW in Israel made up 12.9% of the supply, or 76.7 MCM. A small portion of this NRW was reportedly caused by problems within the physical network such as pipes bursting and leakages, while the larger portion was due to weak administration resulting in illegal connections, the absence of water meters or faulty water meters, and not fully registering public consumption. Baghdali *et al*. (2013) also note that while the national average NRW is 12.9%, in some smaller cities it is much larger, as much as 30–40%. In Jordan, Baghdali *et al*. (2013) report that the NRW rate is 43.59%, due equally to physical issues in the networks (aging networks, pipe bursts, and problems with connections) and administrative problems (illegal connections and inaccurate water metering or meter reading). With regard to the agricultural sector in particular, the Jordan Valley Authority (2011) has reported that the conveyance efficiency of the water distribution network in the Jordan valley is 75% and on-farm water-use efficiency is only 55%.

The recovery of NRW could be an important component to meeting water demands and necessitates resolution of the above issues, to include rehabilitation and modernization of the networks and stricter monitoring and rule enforcement (Baghdali *et al*., 2013). Since 2013, Jordan has launched a national campaign against illegal wells and illegal uses of water in the country (MWI, 2018). From June 2013 to April 2018, 1,063 illegal wells were closed and 38,213 cases of illegal connections to the water network were identified and removed (MWI, 2018).

Another relevant management strategy for both Jordan and Israel is setting water prices to deter overuse of limited resources. In Israel, water tariffs for agriculture are set according to the type of water being used. As outlined in Table 3, potable water ranges from \$0.50 to \$0.75 per m^3 of water in graduated levels to reduce farmer use. For treated wastewater, the price ranges from \$0.24 to \$0.35 per m^3 depending on the treatment plant (Fernandes, 2012; Becker, 2013). For saline water (not listed in the table), the price is slightly less than that for potable water depending on its level of salinity (Fernandes, 2012).

In Jordan, on the other hand, since 1995 the water tariff has not changed for agriculture in the Jordan Valley. The block-rate tariff structure for surface water (used in the Jordan Valley) prices are between \$0.01 and \$0.05 per m^3. For the use of a private agricultural well, as used in the highlands, the prices differ according to whether a farmer has a former abstraction license as per the bylaw No. 85 of 2002 or its 2004 amendment. For those with a license, the water price ranges from *free* to \$0.085/m^3 depending on amount used and for those without a license, from \$0.035 to \$0.098/m^3 depending on usage amount. The fee rates for water consumption for agriculture in Jordan as compared to Israel are low.

The water tariffs in the domestic and industrial sectors in Israel and Jordan also display differences. In Israel, for residential use, water is priced at \$2.40–4.00/m^3 depending on usage. For the industrial sector, potable water is \$1.35/m^3, treated wastewater is \$1.08/m^3, and saline water is 15–25% less than potable water, depending on its salinity (Fernandes, 2012). In Jordan, for residential quarterly (three-month) use, water is priced between \$2.12 and \$2.71/m^3, depending on usage, with fixed costs of between \$3.43–8.08 and \$0.06–1.36/m^3 for wastewater. For household use, there is current action in Jordan to raise the water tariff fixed costs by \$2.82–8.46 depending on the usage amount (The Jordan Times, 2016). The tariff for the use of treated wastewater for industrial use (such as for generating power and for cooling purposes) is \$0.07/m^3.

Water prices for all sectors in Jordan are lower than in Israel. While Jordan's economic situation is not as robust as that of Israel, it might be necessary to consider that Jordan's water prices are still too low for consumers to feel the value of water and thus reduce their usage. Current steps to raise the household water tariff could be an improvement although the agricultural sector is likely where action needs to occur.

Table 3. Water prices in Jordan and Israel, based on sector and water usage.

	Water prices	
	Israel	Jordan
Agriculture[a]	**Potable:** $0.50/m³ (first 50%) $0.60/m³ (next 30%) $0.75/m³ (last 20%) **TWW:** $0.35/m³ (Dan plant) $0.24/m³ (other plant)	**Surface:** $0.01/m³ (0–2,500 m³) $0.02/m³ (2,501–3,500 m³) $0.03/m³ (3,501–4,500 m³) $0.05/m³ (over 4,500 m³) **Well (w/license):** Free (0–150,000 m³) $0.007–0.035/m³ (151,000–200,000 m³) $0.085/m³ (over 200,000 m³) **Well (w/o license):** $0.035/m³ (0–150,000 m³) $0.042/m³ (100,000–150,000 m³) $0.050/m³ (151,000–200,000 m³) $0.098/m³ (over 200,000 m³)
Domestic[b]	$2.40/m³ (up to 7 m³) $4.00/m³ (added m³)	$2.12/m³ (up to 18 m³)* $3.43 fixed costs $0.85 for wastewater $0.11–2.71/m³ (19–72 m³)* $6.77–8.08 fixed costs $0.06–1.36 for wastewater)
Industry[c]	**Potable:** $1.35/m³ **TWW:** $1.08/m³	**TWW:** $0.07/m³

TWW, treated wastewater.
[a]Israel data (Fernandes, 2012; Becker, 2013); Jordan data (Venot & Molle, 2008; Royal Haskoning & MASAR, 2015).
[b]Israel data (Fernandes, 2012; Becker, 2013); Jordan data (Water Authority of Jordan website; The Jordan Times, 2016).
[c]Israel data (Fernandes, 2012; Becker, 2013); Jordan data (Water Authority of Jordan website).
*Quarterly use.

Conclusions

A re-evaluation of the water annex between Jordan and Israel is warranted. As seen from the review of international agreements, common law domestic cases, and international tribunal decisions, equitable apportionment is an established legal principle for allocating access to watercourses contested among jurisdictions. The doctrine argues for an emphasis on sustainable and holistic watershed management in evaluating the often-conflicting, though not necessarily inconsistent, needs of riparian nations.

Such a re-evaluation could either be renegotiated entirely to explicitly incorporate all relevant factors at once or, following the Mexico–US precedent, be amended with a minute system allowing case-by-case flexibility. There are many issues to address if a reassessment of the water agreement between Jordan and Israel is to be achieved but they deserve attention due to the dramatic changes in the development and use of water resources over the past two and a half decades.

Most significantly, due to the current and ongoing conflict in Syria, Jordan's population has expanded rapidly with the influx of refugees. These refugees are living primarily in the major urban centers or camps located within the Jordan River Basin and thus increase the country's within-basin population.

Refugees reside in Israel as well but not of the same magnitude or within the basin. Thus, Jordan's dependence on the Jordan River waters for domestic usage has increased substantially within-basin whereas for Israel it has not. In fact, due to Israel's increased usage of desalination to supply domestic needs, its need for the Jordan River waters has decreased. What is more, while Jordan continues to import water from outside of the basin to supply its rising demands within the basin, Israel continues to pump water from inside the basin to locations outside of the basin.

Israel now sells 10 MCM per year of water to Jordan from Lake Tiberias, a signal that Israel is experiencing some water abundance and can afford to give up more of the waters in the Jordan River Basin. The fact that Jordan pays for this extra water, regardless of whether it deserves it without pay, reveals Jordan's abject water poverty and desperation for water by any means. Furthermore, as per the agreement regarding the desalination of seawater at Aqaba, in exchange for Jordan selling desalinated water to Israel, Israel will sell yet more freshwater to Jordan from Lake Tiberias.

The capacity of Israel to desalinate seawater and treat wastewater should also be considered in comparison to Jordan's still more minimal capacity in these arenas. Israel is to be commended for its accomplishments in creating these supplies of alternative water resources but these accomplishments also deserve a place in the water agreement. In the meantime, Jordan would do well to increase its treatment of wastewater and attempt to match Israel's almost total treatment of all of its wastewater.

One excluded issue from previous discussions is how Jordan allows Israel to pump, without pay, from groundwater aquifers in Wadi Araba on the Jordanian side. Considering the extreme water stress felt in Jordan within the Jordan River Basin, of which the Wadi Araba is a part, and considering that Jordan pays for water from Israel within-basin, there is an argument to be made for Israel either relinquishing some or all of its use of this groundwater or at the least, paying for this within-basin water. Israel could have made concessions in other areas of the treaty in return for continuing to pump groundwater in Wadi Araba, although there is no explicit reference to any such concessions. If such concessions were not in play, this is again an arena for revision.

Many of these conclusions find fault with Israel's position but Jordan has distinct responsibilities as well and needs to reflect on how it can be a better partner in future water agreements. The high percentage of NRW in Jordan signifies a lack of good water management practices. It is hopeful that Jordan has begun to crack down on illegal wells and illegal network connections but more attention needs to be paid to monitoring and network rehabilitation. The low on-farm water use efficiency signals a need for strategies targeted at farmers and their water use practices as well. While Jordan's GDP and general economic status is weaker than that of Israel, its water prices are still a paltry reflection of the value of water. Water prices are a sensitive political issue but some movement on this issue should be expected.

Looking more broadly at the water agreement between Jordan and Israel, the fact that only a part of the Jordan River Basin, the part containing the lower part of the Jordan River, is considered is problematic. Transboundary principles support considering the entire river basin and the case of the Jordan River Basin should be no different. This means that all riparian nations, to include Lebanon, Syria, and Palestine, should be a party to any future treaty and all watercourses leading into the lower Jordan River, to include the various tributaries feeding into the upper Jordan River, should be considered. Everything that happens within the basin at large has an effect on this smaller portion that is taken-up within the agreement and for that reason, all related effects need to be on the table for the next assessment.

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