Jordan River Basin – General Description

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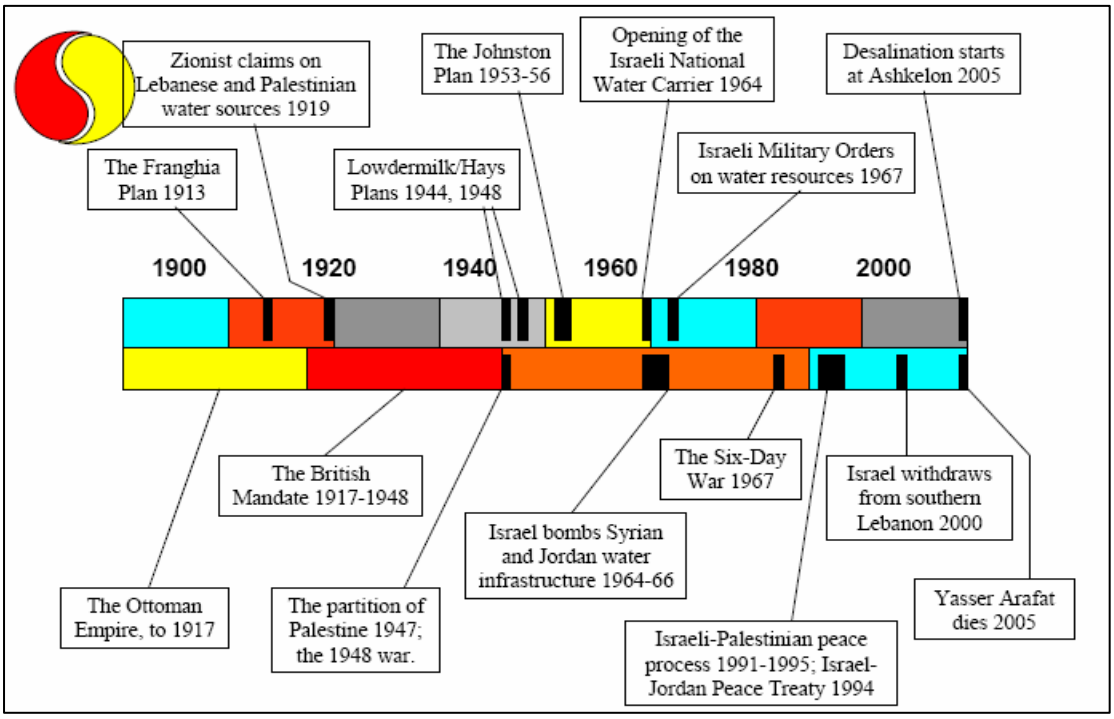
1- Importance

The Middle East region is known not only for its ideological, religious, and geo-political differences and disputes but also for the fact that it is extremely arid. Since its illegitimate establishment in 1948, Israel hostility and claims of rights on water resources was of the primary cause of 1967 Arab-Israeli war. Like other conflicts that revolve around scarce environmental resources, there are ways to determine the likelihood of water issues escalating into a large-scale multi-national conflict.

The relationship among the Jordan River Basin riparian (Lebanon, Jordan, Syria, occupied Palestine, and Palestinian authority) is complicated by the fact that boundaries drawn between these countries (Sykes-Picot) resembles a difficult jigsaw puzzle, which cuts across the sources of the water system.
The chart below gives the major events on Jordan River and its tributaries between the riparian countries. For more details on all events refere to annexe.



Adopted from Philips et al 2005

The Jordan River is the largest and longest river that flows in Palestine. Moreover, it is the only river, within occupied Palestine, that has a permanent flow year round. All other rivers in occupied Palestine dry up for periods of months and do not fill up

until the winter.
The other major rivers in occupied Palestine were contaminated with agricultural and industrial sewage, which makes the Jordan River the only natural and clean river in the country. In spite of its relative large size in Palestine, is actually a small river in international terms.

2- Jordan River Basin

Jordan is a Trans Boundary River between four countries. The River Basin has 18500 square kilometer. The riparian countries are by order of importance Palestine (Palestinian occupied territories and the state of Israel), Jordan, Syria and Lebanon. Figure one shows the location of the River Basin.
Table one gives the area and percentage of the total area of the basin by country.

Table 1 : Jordan River Basin Area Repartition Between Riparian Country		
Countries	**Area of country in basin Km2**	**Percentage from Basin area**
Jordan	7,470	40.38
Israel	6,830	36.92
Syrian Arab Republic	1,910	10.32
Occupied Palestinian Territory	1,620	8.76
Lebanon	670	3.62
Total	**18,500**	**100**

These three tributaries combine in Huleh Valley into the Jordan River, which then flows south into Lake Tiberias (referred to in the Bible as the Sea of Galilee).

As shown in figure 2, the region where is located the river basin is, for the region, a wet region having an average rainfall between 500 and 1000 mm/year.

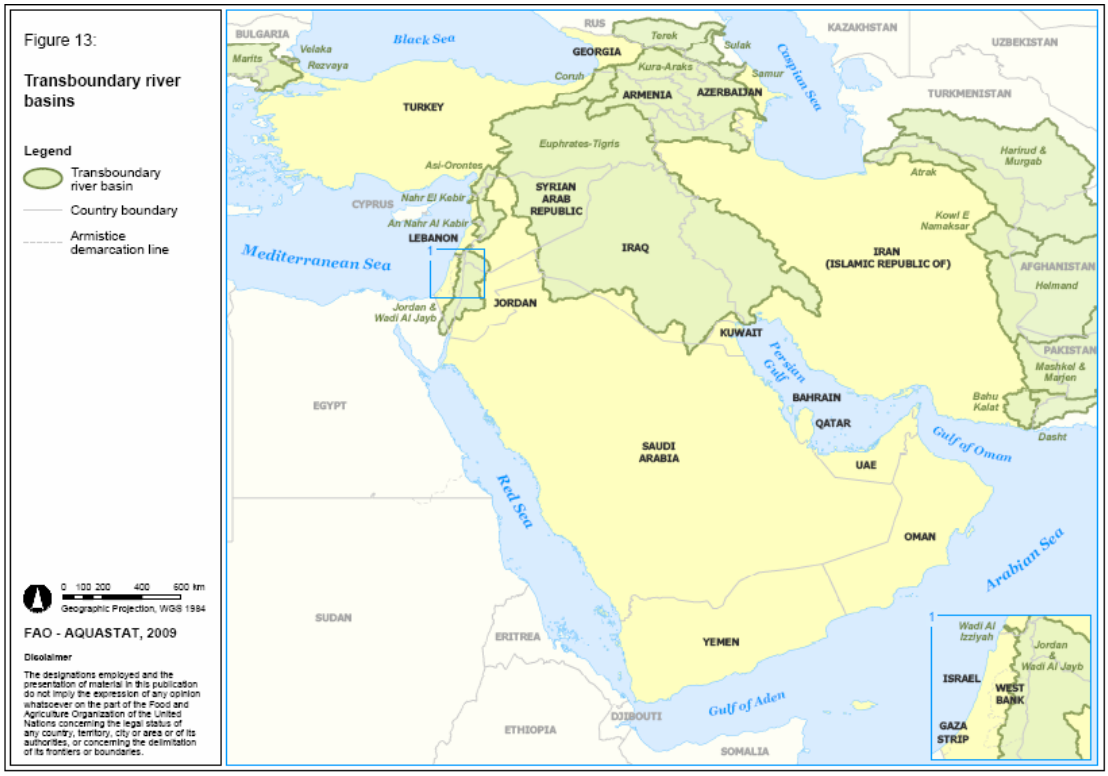
2-1- Jordan River and Tributaries

The Jordan River flows in a narrow valley. Its average width is about 1200 meters, and sometimes it limits itself into 500 meters only. Figure three show Jordan River
The lower part of the river between Lake of Galilee and the Dead Sea is very curved. While the air distance between Lake of Galilee and the Dead Sea is 105km, the flow distance is 223km.
The Jordan River basin is formed by two rivers: The Jordan and the Yarmouk.

The Jordan, which runs from north to south, has as its source three spring-fed streams:

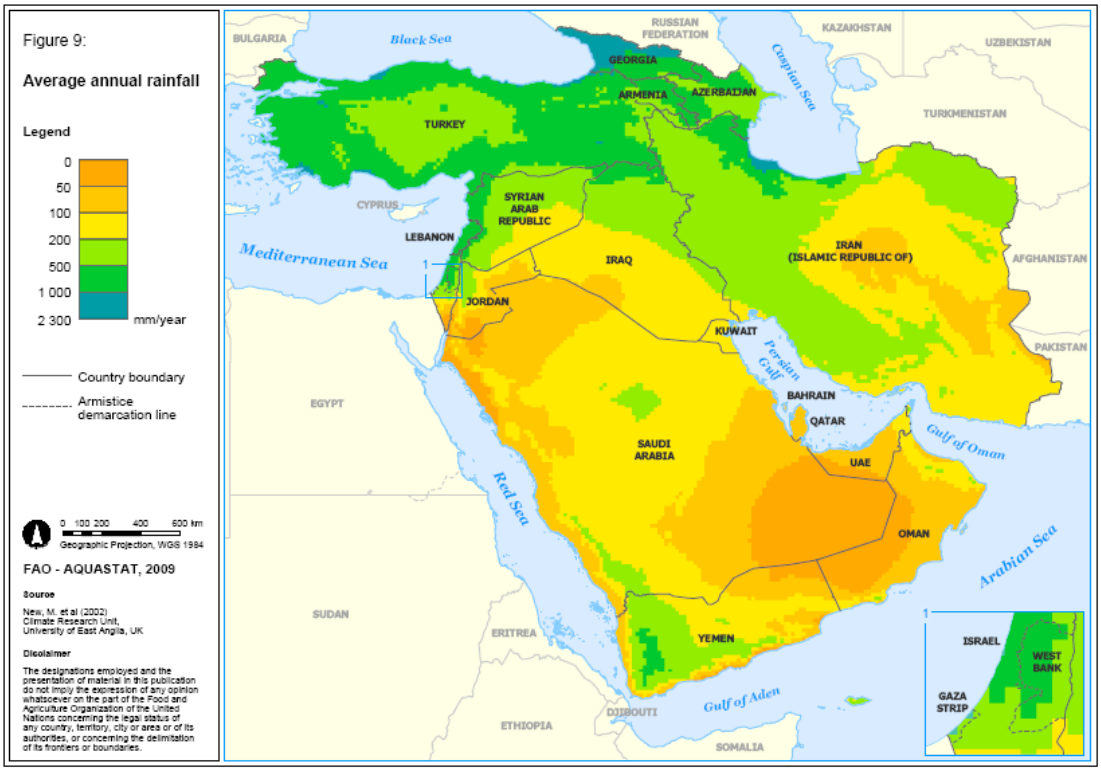
- The Hasbani - Wazani in Lebanon
- Banyas begins in Syria, and
- The Dan

Figure 1: Jordan River Basin Location



Source: FAO- AQUASTAT

Figure 2: Average annual Rainfall



Source: FAO- AQUASTAT

Figure 3: Jordan River Basin and tributaries across the riparian countries

Source PA SSIA

The Yarmouk River arises to the East of the Jordan River in Syria. Emerging from Syrian territory, the Yarmouk forms the boundary between Jordan and Syria for 13 Km (8 miles), then forms the boundary between Jordan and occupied Palestine.
The Yarmouk and Jordan Rivers converge below the Southern part of Lake Tiberias (Sea of Galilee) and then flow through the Jordan Valley into the Dead Sea 113 Km (70 miles) downstream.
The Jordan River forms the boundary between Jordan and occupied Palestine, and later between Jordan and the West Bank. The Yarmouk River is approximately 40% of the total flow.
The flow of the three spring-fed streams, which form the headwaters of the Jordan River, is variable:

- The Dan is the least variable, ranging from 173 to 285 Mm3/yr., averaging 230 Mm3/yr and contributes about half of the normal flow of the Jordan.
- The Hasbani varies from 52 to 236 Mm3/yr., averaging 160Mm3/yr (Fawaz, 92), 175Mm3/yr (Jaber, 95), 160Mm3/yr. (Qomair, 98), 145Mm3/yr. (Nasrallah, 2000), 138 Mm3/yr. (Hudes, 1999).
- The Banyas varies from 63 to 190 Mm3/yr., averaging 120 Mm3/yr

2-2- Jordan River Basin main Characteristics.

After these three streams meet in Palestine to form the Jordan River an average of 640 Mm3/yr. flows from the Jordan into Lake Tiberias, 130 Mm3/yr. is contributed by local run-off.
Lake Tiberias has an area of 170 km2, and a volume of 4,000 Mm3 (6.5 times the Jordan's average annual inflow and 8 times its average outflow.) (Salaimeh, 1990).
An average of 500 Mm3/yr. passes further south from occupied Palestine into the Jordan River. Table 2 gives details of flows by river.

Table 2: Jordan River Basin and its Tributaries Flow in MCM

Upper Stream Flow			
River	**Flow Estimation**		
	Minimum	Maximum	Average
Dan	173	285	230
Hasbani	52	236	160
Banyas	63	190	120
Local Runoff before Tiberias			130
Total Upper stream	288	711	640
Downstream Flow			Average
Yarmouk			500
Zarqa River, wadis and local springs.			523
Occupied Palestine			500
Total Downstream			1523
Total General			**2163**

2-3- Dams on Jordan and Tributaries

Rain falls in the north of the Jordan River from October to May, with heaviest rainfall during the winter. In the winter, the side streams that feed the Jordan River become very full, while in the summer, they dry up.
In order to use the waters in the system effectively, it is necessary to provide means to collect and store water during the winter, for use during the summer. Many dams are constructed along the Jordan and its tributaries. Table 3 summarizes these dams, theirse characteristics and water use.
Yarmouk and Jordan River waters that are not diverted or stored eventually flow into the Dead Sea and become commingled with its saline waters.

Table 3 :Large Dams on the River Basin

Country	Name	Nearest city	River	Year	Height meter	Capacity Mm3	Main Use
Jordan	King Talal	Jarash	Zarqa River	1987	108	75	I,F,H.N
	Karamah	Al-Balqa	Wadi al Mallaha	1998	45	53	I,F,R
	Wadi Arab	Ibrid	Wadi Arab	1986	84	20	I,W,F,N,R
	Shurhabil ben Hasna	Ibrid	Wadi Ziglab	1967	1	4	*I,W,F*
	Kafreine	Al-Baqa	Wadi Kafrein	1997	37	9	I,F,R,O
	Kafreine	Al-Balqa	Wadi Shueib	1969	32	2	
Jordan & Syrian Arab Republic	Wahda	Irbid	Yarmouk	2007	87	110	I,W,F,O,H
		Dara (S)					
Total						**273**	

I= Irrigation, H=Hydropower, W= Water Supply, F= Flood protection, R=Recreation, N=Navigation and Other

Source : FAO - AQUASTAT

2-4- Water Quality

Water quality is variable in the river basin:
The three tributaries of the upper Jordan (the Dan, Hasbani, and Banyas) have a low salinity of about 20 ppm.
The salinity of the Yarmouk River is also satisfactory, at 100 ppm.
The salinity of water in Lake Tiberias ranges from 240 ppm in the upper portion of the lake to 350 ppm where it discharges into the Jordan River.

The salt comes from the saline subterranean springs. These springs pass through the beds of ancient seas and then flow into Lake Tiberias, as well as the groundwater sources that feed into the lower Jordan.

The lower Jordan River becomes progressively more saline as it flows south.
The salinity reaches twenty-five percent (250,000 ppm), when it ends in the Dead Sea.
This salinity increase because water reaching the Dead Sea from Jordan decrease very fast as shown in table 4.

Table 4: Historical Flow of Jordan River into the dead Sea	
Year	**Flow (MCM/Year)**
1948	1600
1967	700
1982	500
1990	150
2003	75
Source: Marwan Haddad August 2009	

Actually The Dead Sea receives an average flow from the Jordan River of 50*Mm3/yr*.

The natural salinity of the Jordan River has been exacerbated by the extensive exploitation of high quality water by Israel.
Israel extracts water from the northern edge of Lake Tiberias at Eshed Kinrot to feed into the National Water Carrier, a water system constructed in 1964 to convey water to coastal areas and to the Negev as shown in figure 4.

2-5- Underground Water

The most important source of water in the Jordan River basin is groundwater. The groundwater reservoir beneath the West Bank is the largest water resource in the region, supplying 600 *Mm3* of water per year.
This aquifer is the source of 35% of Israel's total annual consumption; for the Palestinians in the West Bank, the aquifer provides 90% of their annual consumption.

This aquifer can be divided into three major basins:

- West: the Yarqon Tanninim basin which supplies 360 Mm3/yr . of water. Israel uses 340 Mm3/yr. of this water; Palestinians in Qalqilya and Tulkarim use the remaining 20 Mm3/yr., through springs and wells.
- North: The Nablus-Gilboa basin, which supplies 140 Mm3/yr. of water.Israel uses 115 Mm3/yr. of this water, and 25 Mm3/yr. is used by Palestinians for irrigation through Wadi Farih, Bardela and other small springs.
- East: this basin yields 100 Mm3/yr. of water. Israel uses 40 Mm3/yr. of this water; and the Palestinians use 60 Mm3/yr.

Figure 4: Israel National Water Carrier

Source PASSIA

Figure 5: The Aquifers Repartition in Palestine (West Bank)

Israel uses 495 *Mm3/yr*. and the Palestinians use 105 *Mm3/yr*.Prior to 1967, Israel had used 455 *Mm3* of the groundwater. After 1967, the Israelis developed a new well system on the upper slopes of the West Bank, which makes it possible to retrieve more groundwater before it becomes saline.

Table 5: West Bank Basin Recharge and Use in MCM (1)				
Basin	**Annual Use**			**Annual Recharge**
	Israel	***Palestine***	***Total***	***Oslo2 values(2)***
Eastern	40	60	100	172
Northeastern	115	25	140	145
Western	340	20	360	362
Total	**495**	**105**	**600**	**679**
Percentage	**82.5**	**17.5**	**100**	

(1) *Salaimeh* (2) Marwan Haddad August 2009

3-Conclusion

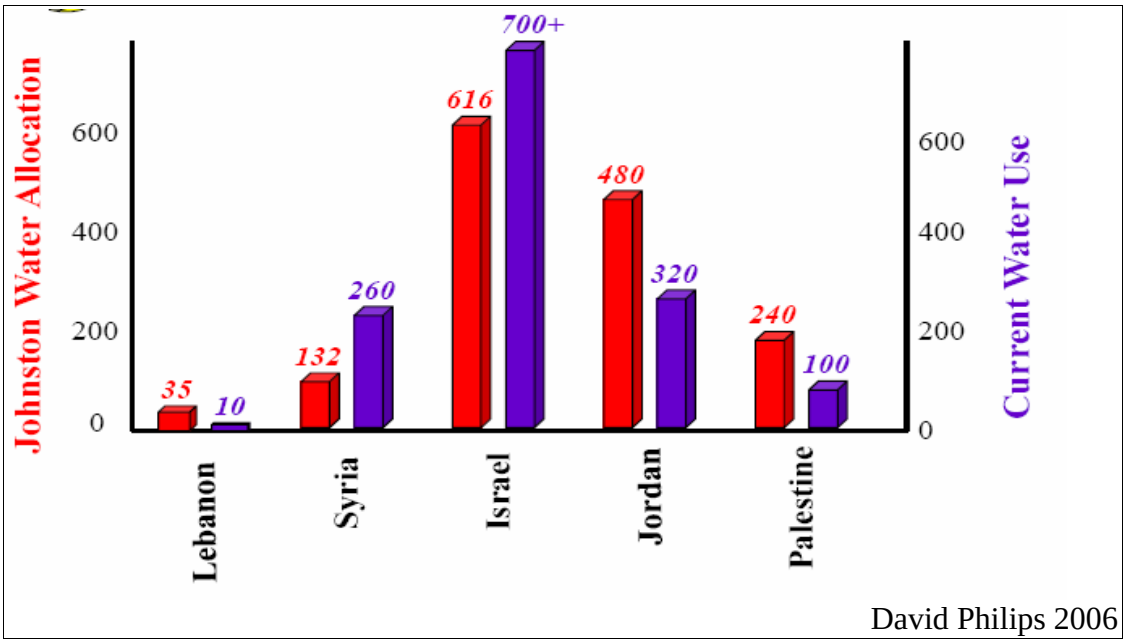
Since 1913 the Jordan River is matter of conflict between Israel and the riparian countries of Jordan River.

In spite of the non equitable Johnston plan (Table 6) and its favoritism, and after more than fifty year, Israel increase its homogeny over Jordan River Water and don't respect this plan.

Table 6: Johnston Plan- Water allocation to Riparian of Jordan River in MCM/Year					
Source	Lebanon	Syria	Jordan	Israel	Total
Hasbani	35				35
Banias		20			20
Jordan		22	100	375	497
Yarmouk		90	377	25	492
Side Wadis			243		243
Total	35	132	720	400	1287

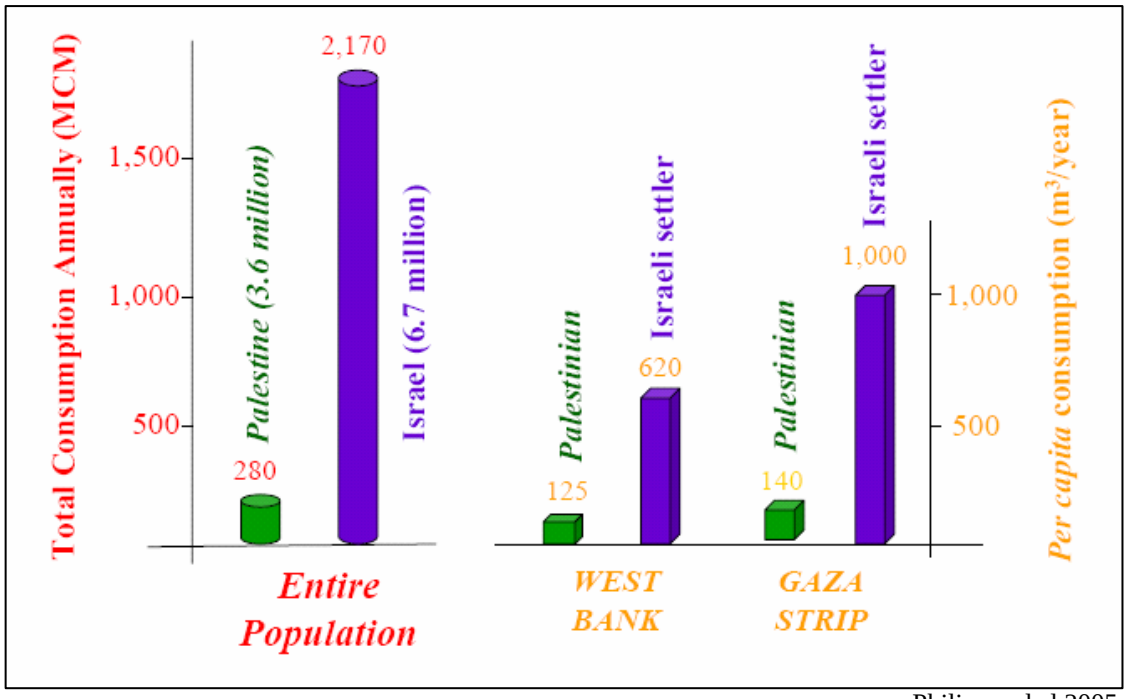
Figure 6 show the disproportion on water use between Johnston plan and actual water use.

Figure 6: Volumetric Allocation in Jordan River



After 1967 war, Israel occupied territories in riparian countries included West Bank. This occupation gives Israel the oportunity to increase its exploitation of Jordan River Basin water. The surface water is carried by the National Water Carrier ; and by a new well system 82.5% of the underground water is exploited by Israel . The actual use of water is not equitable repartition as shown in figure 7.

Figure 7: The present inequitable allocation of water



Philips and al 2005

Annex: Chronology of major events in the Jordan River Basin

Chronology of major events in the Jordan River Basin

Year	Plans/projects/treaties/conflicts	Countries & territories involved	Main aspects
1913	Franjieh Plan	Ottoman Commission	Irrigation of the Jordan Valley, transferring Yarmouk River flows to Lake Tiberias, generating electricity.
1951	Jordan announced Plan	Jordan	Jordan Plan to divert part of the Yarmouk river via the East Ghor canal.
1953	Israel began construction of the National Water Carrier (NWC)	Israel	Resulting in military skirmishes between Israel and the Syrian Arab Republic.
1955	Johnston Plan	USA. Riparian countries	Allocation of water: 55% for Jordan, 36% for Israel, 9% each to the Syrian Arab Republic and Lebanon. Not signed because Arab riparian countries insisted the USA was not impartial.
1964	The NWC opened and began diverting water from the Jordan River Valley	Israel	This diversion led to the Arab Summit of 1964.
1964	Arab Summit	Arab League	A plan was devised to begin diverting the headwaters of the Jordan River to the Syrian Arab Republic and Jordan.
1965–1967	Israel attacked construction projects in the Syrian Arab Republic	Israel, Syrian Arab Republic	This conflict, along with other factors escalated in the Six Day War in 1967.
1967	Six Day War	Egypt, Israel, Jordan, Syrian Arab Republic, Occupied Palestinian Territory	Israel destroyed the Syrian diversion project and took control of the Golan Heights, the West Bank and the Gaza Strip. Palestinian irrigation pumps on the Jordan River were destroyed or confiscated after the Six Day War and Palestinians were not allowed to use Jordan River water. Israel introduced quotas on existing Palestinian irrigation wells and did not allow any new ones.
1969	Israel attacked Jordan's East Ghor Canal	Israel and Jordan	Because of suspicions that Jordan was diverting excess amounts of water. Later on, Israel and Jordan acquiesced to the apportionment contained in the non-ratified Johnston Plan.

Source: FAO - AQUASTAT

Annex: Chronology of major events in the Jordan River Basin (Cont')

1978	Israel's invasion of Lebanon	Israel and Lebanon	Giving Israel temporary control of the Wazzani spring/stream feeding the Jordan.
1987	Syrian Arab Republic and Jordan agreement	Syrian Arab Republic and Jordan	Defined the Syrian share of the Yarmouk and limited the Syrian Arab Republic to 25 dams with a capacity of 156 million m^3. The Wadha (Unity) Dam was included.
1993	Declaration of Principles on Interim Self-Government Arrangements	Israel, Occupied Palestinian Territory	Called for Palestinian autonomy. Creation of the Palestinian Water Administration Authority. Water Development Programme.
1994	Washington Declaration and Treaty of Peace	Israel and Jordan	Israel and Jordan signed The Washington Declaration, ending the state of belligerency and negotiated the Treaty of Peace. Allocations for Yarmouk and Jordan rivers and efforts to prevent water pollution.
1995	Israeli-Palestinian Interim Agreement on the West Bank and the Gaza Strip (Oslo II)	Israel, the West Bank, and the Gaza Strip	Israel recognized Palestinian water rights (during the interim period a quantity of 70–80 million m^3 to be made available to the Palestinians). A Joint Water Committee was established to cooperatively manage West Bank water and to develop new supplies.
1996	Israel tries to begin talks on water resources with the Syrians	Israel and Syrian Arab Republic	Syrian Arab Republic refuses because of the conflict concerning the Golan Heights.
1999	Israel reduces the quantity of water piped to Jordan by 60 percent	Israel and Jordan	Due to drought. This reduction caused a sharp response from Jordan.
2002	The Wazzani Conflict	Israel, Lebanon	Lebanon announced the construction of a new pumping station at the Wazzani springs causing tension between Israel and Lebanon.
2003	Roadmap for Peace	Israel, Occupied Palestinian Territory, The Quarter	Purpose: to end of the Israel-Palestinian conflict.
2007	Jordan and Syrian Arab Republic agreements	Jordan and Syrian Arab Republic	Implementation of agreements signed between the two countries, especially with regard to shared water in the Yarmouk river basin.
2008	Negotiations between Israel and the Syrian Arab Republic	Israel and Syrian Arab Republic	Negotiations are taking place in order to resolve the the Golan Heights conflict.