

Asi-Orontes River Basin

GEOGRAPHY, CLIMATE AND POPULATION

The Asi-Orontes River Basin is a transboundary basin with a total area of about 24 660 km² of which 69 percent is located in the Syrian Arab Republic, 23 percent in Turkey and 8 percent in Lebanon (Lehner *et al*, 2008) (Table 1 and Figure 1). The Asi-Orontes is the only river in the region flowing in northern direction, draining from western Asia to the Levant coastline of the Mediterranean Sea. The river rises in the mountains of Lebanon and flows 40 km in Lebanon to continue into the Syrian Arab Republic for about 325 km before arriving in Turkey for its last reach of 88 km to the Mediterranean Sea (UNESCO-IHE, 2002). The river rises in the great springs of Labweh on the east side of the Bekaa Valley and it runs in a northern direction, parallel with the coast, falling 600 m through a rocky gorge. Leaving this, it expands into the Qattinah Lake, having been dammed back in antiquity. The valley now widens out into the rich district of Hama, below which lie the broad meadow-lands of Amykes, containing the sites of ancient Apamea. This central Asi-Orontes valley ends at the rocky barrier of Jisr al-Hadid, where the river is diverted to the west and the plain of Antioch opens. Two large tributaries from the north, the Afrin and Karasu, reach it here through the former Lake of Antioch or Lake Amik, which is now drained through the artificial Nahr al-Kowsit channel. Passing north of the modern Antakya (ancient Antioch) the Asi-Orontes plunges southwest into a gorge and falls 50 m in 16 km to the sea just south of the little port of Samandagi.

The average annual precipitation in the basin is estimated at 644 mm, although it varies all along the basin area. Annual average temperature of the entire Asi-Orontes River Basin is estimated at 16 °C. Average temperature in the basin in January is 6 °C, although it can drop to -1 °C in the coldest places of the basin. In August, the average temperature reaches 25 °C, rising to 28 °C in the hottest places (New *et al*, 2002). In the Lebanese part of the Asi-Orontes Basin, the climate is semi-arid to arid, with annual rainfall below 400 mm (Estephan *et al*, 2008). In the Syrian part, the western mountains receive precipitation ranging from 600 to 1 500 mm, while in the eastern parts of the basin it is much lower, ranging from 400 to 600 mm (FAO, 2006). The Turkish part of the basin is a transition zone between the Mediterranean and Eastern Anatolian climatic zones. While a southeastern climate prevails in the eastern part of this basin, the western parts is dominated by a Mediterranean climate.

WATER RESOURCES

The Asi-Orontes River and its tributaries collect the runoff from the highlands and plateau areas situated on both sides of the rift valley. The average annual flow of the river is estimated at 2 400 million m³, but the surface water amount in the basin has been

TABLE 1
Country areas in the Asi-Orontes River Basin

Basin	Area		Countries included	Area of country in basin (km ²)	As % of total area of the basin	As % of total area of the country
	km ²	% of the Middle East				
Asi-Orontes	24 660	0.38	Syrian Arab Republic	16 910	68.6	9.1
			Turkey	5 710	23.1	0.7
			Lebanon	2 040	8.3	19.6

FIGURE 1
Asi-Orontes river basin



Legend

- | | | | | | |
|--|-------------------------|--|---------------------------|--|--|
| | International boundary | | Lake | | Zone of irrigation development |
| | Administrative boundary | | Intermittent lake | | Southeastern Anatolia Project (GAP), ongoing |
| | Capital, town | | Salt pan | | Irrigation scheme |
| | River basin | | River, intermittent river | | |
| | | | Canal | | |
| | | | Dam | | |

0 10 20 40 60 km
Albers Equal Area Projection, WGS 1984

FAO - AQUASTAT, 2009

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re-estimated at 1 110 million m³ (FAO, 2006). The Al-Azraq spring is a very important tributary to the Asi-Orontes with an annual flow of more than 400 million m³. There are several bid springs: Al Ghab, Al Rouj, and Al Zarka (FAO, 2006).

The annual flow from Lebanon to the Syrian Arab Republic is 415 million m³, of which an informal agreement between these two countries attributes 80 million m³ to Lebanon and the rest to the Syrian Arab Republic. The natural annual flow from the Syrian Arab Republic to Turkey is estimated at 1 200 million m³, while the actual flow amounts to 12 million m³.

The intensive use of groundwater by agriculture in the last decade has resulted in depletion of the water storage in the aquifers, lowering of the groundwater table and considerable reduction of the spring yield. The average annual discharge of 26 springs in Al Ghab valley dropped from 18.5 m³/s in the period 1965–71 to 9.7 m³/s in 1992–93 and declined steadily to 4.2 m³/s in 1995–96. The amount of groundwater in the Syrian part of the Asi-Orontes Basin is estimated at 1 607 million m³; most of it flows as springs (1 134 million m³) and the rest (473 million m³) is stored into aquifers and withdrawn from wells for irrigation and water supply.

WATER QUALITY

Water quality is good in the headwaters, while due to anthropogenic inputs associated with agricultural, urban, and industrial activities it deteriorates in the middle section of the river.

WATER-RELATED DEVELOPMENT IN THE BASIN

The total area equipped for irrigation in the Asi-Orontes River Basin is estimated at 300 000–350 000 ha, of which approximately 58 percent in the Syrian Arab Republic, 36 percent in Turkey, and 6 percent in Lebanon. Agricultural water withdrawal is approximately 2.8 km³.

The Asi-Orontes Basin is an important agricultural area, contributing to the regional economy.

In the Lebanese Bekaa valley, the most important crops are fruits, vegetables, field crops, and forests and rangeland. However, poor management of natural resources and poor integration of production systems produce low farm income and unsustainable farming (Estephan *et al*, 2008). To obtain water for irrigation, two water regulators have been placed in Lebanon on the Asi-Orontes (El-Fadel *et al*, 2002).

In the Syrian part of the basin the total area irrigated increased from 155 300 ha in 1989 to around 215 000 ha in 2008. The expansion of irrigation using groundwater has been most intensive in the Al Ghab valley and the Mohafazat of Idleb. In the Al Ghab region, the areas irrigated with groundwater have increased and the areas irrigated with surface water have decreased. The annual amount of groundwater used for water supply, irrigation and industry is more than 1 607 million m³, while the annual renewable amount in aquifers is less than 473 million m³, meaning an over-abstraction of 1 134 million m³ (FAO, 2006).

In the Syrian Arab Republic, regulation of the Asi-Orontes River flow to increase its irrigation capacity began with the reconstruction of the ancient Qattinah Dam in 1937, completed in 1976, and the construction of the dams at Rastan and Mhardeh on the main river stream in 1960, the first large dams built in the Syrian Arab Republic. These reservoirs control about 12 600 km² of the Asi-Orontes drainage basin upstream of Mhardeh. The total capacity of the three reservoirs (495 million m³) represents about 45 percent of the estimated average annual flow yield. Until 2002 the dams built in the Syrian part of the basin numbered 41, with total a reservoir capacity of 741 million m³, all built on tributaries of the Asi-Orontes River. Among the dams with large reservoir capacity is the Zeyzoun Dam (71 million m³) which had been damaged

TABLE 2
Large dams in the Asi-Orontes River Basin

Country	Name	Nearest city	River	Year	Height (m)	Capacity (million m ³)	Main use*
Syrian Arab Republic	Al Rastan	Hims	Asi-Orontes	1960	67	228	I
	Qattinah	Hims	Asi-Orontes	1976	7	200	I
	Mhardeh	Hamah	Asi-Orontes	1960	41	67	I
	Zeyzoun	Hamah	-	1995	43	71	I
	Kastoun	Hamah	-	1992	20	27	I
Turkey	Karamanli (Hatay)	Hatay	Bulanik	1985	35	2 000	I
	Yarseli	Hatay	BeyazCay	1989	42	55	I
					Total	2 648	

* I = irrigation; H = Hydropower, W = Water Supply; F = Flood protection; R = recreation; N = Navigation; O = Other

in 2002. The Zeita Dam, one of the most recently built dams, will have a total capacity of 80 million m³ (SPC, 2009).

In Turkey, the Lake of Antioch or Lake Amik was a large freshwater lake in the Asi-Orontes River Basin in Hatay Province which is now drained through the artificial channel Nahr al-Kowsit. Sedimentary analysis suggests that Lake Amik was formed, in its final state, in the past 3 000 years by episodic floods and silting up of the outlet to the Asi-Orontes. This dramatic increase in the lake's area displaced many settlements; the lake became an important source of fish and shellfish for the surrounding area and the city of Antioch. The lake was drained during a period from the 1940s–1970s. The most important dams located on the Turkish side of the basin are the Karamanli Dam and the Yarseli Dam. Table 2 shows the large dams in the Asi-Orontes River Basin, i.e. dams with a height of more than 15 metres or with a height of 5–15 metres and a reservoir capacity greater than 3 million m³ according to the International Commission on Large Dams (ICOLD).

TRANSBOUNDARY WATER ISSUES

Mainly non-navigable and of relatively little use for irrigation, the Asi-Orontes derives its historical importance from the convenience of its valley for traffic from north to south; roads from the north and northeast, converging at Antioch, follow the course of the stream up to Hims, where they built the Al-Rastan Dam, before forking to Damascus and to the Syrian Arab Republic and the south. The Asi-Orontes has long been a boundary marker. For the Egyptians it marked the northern extremity of *Amurru*, east of Phoenicia. For the Crusaders in the 12th century, the Asi-Orontes River became the permanent boundary between the Principality of Antioch and that of Aleppo.

The Syrian Arab Republic has been using 90 percent of the total flow, which reaches an annual average of 1 200 million m³ at the Turkish-Syrian border. Out of this total capacity, only a meagre 12 million m³ enter Turkey after heavy use by the Syrian Arab Republic.

In August 1994, the Lebanese and Syrian governments reached a water-sharing agreement on the Asi-Orontes River, according to which Lebanon receives 80 million m³/year and the remaining 335 million m³ are for the Syrian Arab Republic if the river's flow inside Lebanon is 400 million m³ or more during that given year. If this figure falls below 400 m³, Lebanon's share is adjusted downwards, relative to the reduction in flow. Wells in the river's catchments area that were already operational before the agreement are allowed to remain operational, but no new wells are permitted.

In 2009 Turkey and the Syrian Arab Republic have agreed in principle to develop the "Asi Friendship Dam", to be built on the Asi-Orontes River on the border between the Syrian Arab Republic and Turkey. The dam is expected to be approximately 15 m

high with a capacity of 110 million m³. Of that total, 40 million m³ will be used to prevent flooding and the rest for energy production and irrigation. The idea to build a shared dam on the Asi-Orontes River has been discussed over the years between Turkey and the Syrian Arab Republic, but political differences between the countries held them back until now.

Table 3 shows the main historical events in the Asi-Orontes River Basin.

TABLE 3
Chronology of major events in the Asi-Orontes River Basin

Year	Plans/projects/treaties/conflicts	Countries involved	Main aspects
1937	Reconstruction of the Qattinah dam	Syrian Arab Republic	Reconstruction of the ancient Qattinah dam, completed in 1976.
1939	French colonization of the Syrian Arab Republic	Syrian Arab Republic, Turkey, France	The Asi-Orontes terminates in Hatay (Alexandretta) province, which is Syrian land given to Turkey by France in 1939 during the French colonization of the Syrian Arab Republic.
1940s–1970s	Lake Amik drained	Turkey	Lake Amik was drained in the period running from the 1940s to the 1970s.
1950s	Ghab Valley Project	Syrian Arab Republic, Turkey, Lebanon	The Syrian Arab Republic applied for World Bank loans to build its Ghab Valley Project. Turkey requested that the project be revised. Later, the Syrian Arab Republic withdrew its requests for the loans it had negotiated.
1994	Agreement on water quantity	Lebanon, Syrian Arab Republic	Bilateral agreement, concerning the division of the water of the Asi-Orontes river between the Syrian Arab Republic and Lebanon.
2002	Floods	Syrian Arab Republic, Turkey	El Zeyzoun dam, located near the city of Hama in the Syrian Arab Republic, suddenly released about 70 million m ³ . 22 Syrians lost their lives and the flood damaged some villages in the Syrian Arab Republic and cultivated land in Turkey.
2009	Agreement to develop the "Asi Friendship dam"	Syrian Arab Republic, Turkey	Turkey and the Syrian Arab Republic have agreed in principle to develop the "Asi Friendship Dam," to be built on the Asi-Orontes River on the border between the Syrian Arab Republic and Turkey.

