

Addressing the Complexity and Uncertainty of Water Management in the Orontes River Basin

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Water management at the scale of a watershed is generally a complex issue not only because of the multiple interactions between the hydro-physical and socio-economic-political systems, but also between the components of the two systems that are further encumbered by many uncertainties.

River basins are dynamic systems evolving in time and space in response to internal and external changes. The limits of a watershed are defined by the topographic drainage divide. However, subsystems interacting in the drainage area do not have such clear-cut boundaries. Their spatial and temporal limits can be defined in different ways depending on the perspective and the problem at hand. Boundaries of river basins, as dynamic systems, are thus flexible and cannot be strictly defined. Properties of nested subsystems with numerous interconnections and imprecise spatial and temporal limits are uncertain. Water management problems are consequently unavoidably "ill formed". They indeed have no single best solution but, in contrast, multiple answers, generally difficult to precisely measure and control, responding more or less to the needs of different interest groups (Brown 2009).

Complexity and uncertainty are constituent features of river basin systems; they can be interpreted as an opportunity for concerted water management or used as an obstacle. In this respect, technical and scientific expertise plays a central role depending on how complexity and uncertainty are addressed. Expertise commissioned by specific interest groups generally aim to provide specific solutions, often predefined, responding to the commissioners' need. To do so, complexity and uncertainty are necessarily minimized to simplify the problem. Results produced by studies related to different interest groups will provide different answers according to their disciplinary perspective. Depending on the political context, this may or not open grounds for negotiations between the concerned interest groups while excluding others.

Addressing the complexity and uncertainty as such cannot provide direct solutions to water management problems. The aim is to develop a knowledge base to analyze the sources of complexity and uncertainty, the nested hydro-physical and socio-economic-political systems and subsystems in order to identify options and challenges and opportunities for concerted water management.

The Orontes River basin is undoubtedly complex. The history of human settlement and the spatial distribution of activities are largely related to the availability and exploitation of water resources (Weulersse 1940). The oldest dated water infrastructures, dating back to the Bronze Age, are found in the upper reach of the basin. These installations were extended in the Hellenistic, Roman and Byzantine periods and restored from the 1920s (Chambrade and Saadé-Sbeih 2015). While the Orontes River and the numerous springs located in the basin were the main source of water until recently, underground resources currently provide over 50% of the water extracted in the basin. Furthermore, over 80% of the surface water originates from springs fed mainly by the karstic hydrogeological structures (Zwahlen et al. 2014; Droubi 2013). Groundwater management has become a critical issue and is strongly related to the socio-economic-political system which was partly shaped in relation to the access to water.

The Lebanese section of the Orontes River basin, the northern Beqaa valley, is often viewed as poor and marginal. However, it is an area where large private investments in irrigation development have been made in the past three decades. The Lebanese and Syrian sections of the basin, in many respects, contrast each other, in terms of the intensity of the exploitation of water resources, the structure of the economy and the role of State in governing water resources. They are also closely interlinked making transboundary water management a complex issue in which the water-sharing agreement between the two countries is one element among others (Hamade et al. 2015).

With more than four million inhabitants, the Orontes River basin in Syria, is an area of prime importance for both agriculture and industry. The basin contains the two major urban centres of Homs and Hama, several medium size cities and a wide range of industrial activities. The land irrigated using surface water and groundwater covers over 290'000 hectares, and is close to the area irrigated in the Euphrates basin that has received more a lot of attention in the past four decades. Prior to the conflict, the Orontes basin provided a quarter of the agricultural production and accounted for a third of industrial production of the country. The distribution of population, agricultural and industrial activities are largely related to the availability and access to water resources. The oldest water infrastructure dates back to the Bronze Age. Those in the upper reach of the basin could even be older. These installations were extended in the Hellenistic, Roman and Byzantine periods and restored from the 1920s. The Al Ghab Irrigation Development Plan initiated in the late 1950s was the first agricultural achievement of the Ba'ath Party after it took power in 1963 (Métral 1984). Farmers cultivating irrigated lands in the Orontes basin were among the main beneficiaries of the agrarian reforms and the centralized agricultural policy until the second half of the 1970s. Later, the Euphrates river basin program became the national priority for irrigation projects.

The Orontes basin became one of the first industrialized regions of Syria with the establishment in Homs of state plants such as the sugar factory in 1948 and oil refinery in 1957. Industrialization accelerated in the 1990s with the establishment of private factories in particular chemical and pharmaceutical plants. The agricultural and industrial development in the region, led to a strong growth in the population of the basin reflecting the large ethnic and confessional diversity of the country.

The city of Hama is sadly notorious for having suffered a 27-day siege to crush the insurgency led by the Muslim Brotherhood in February 1982. The massive offensive that resulted in a death toll of 10,000 to 40,000 put an end to the Islamist opposition that first became active in the 1970s. At this time, the urban and rural population of the Orontes basin was, however, largely supportive of the regime. Following the progressive deterioration of economic and social conditions, the rural basis of the regime steadily eroded.

From the 1980s, new developments such as small and medium capacity dams induced a growing asymmetry that favored the western sectors of the basin. Fur-

thermore, parallel to the centralized planning of agricultural production, the regime adopted a clientelist strategy permitting, among others, the drilling of unauthorized wells and smuggling of subsidized diesel and fertilizers. In the late 2000s, the proportion of illegal wells in the districts of the Orontes basin located in the provinces of Hama and Homs were respectively 56% and 59%. Uncontrolled groundwater extraction led to a decline in the flow of springs feeding irrigation schemes and other domestic and industrial water supply networks. Industrial expansion and urban growth generated a growing water pollution problem. The two water treatment plants, with limited efficiency, could only provide a partial solution to the pollution problem. The erosion of the rural basis of the regime accelerated in the 2000s with the economic crisis affecting the planned agricultural sector. The center of the Orontes basin, once a stronghold of the Ba'ath party, became a protest hotspot. The state-controlled prices of strategic agricultural commodities such as wheat, cotton and sugar beet remained unchanged from 1996 to 2007. This induced a marked decrease in farm income because of the rise in the cost of labor, equipment and unsubsidized inputs. In the course of the 2000s, the clientelist redistribution did not disappear, instead benefited a much smaller group to the detriment of a large number of former beneficiaries including farmers, traders and government employees. The crisis was exacerbated by two dry years in 2007 and 2008. This increased the need for irrigation. In 2007, the removal of subsidies on diesel and the year after, on fertilizers were a drastic shock. Farmers were meant to be compensated by the rise in the prices of strategic commodities and direct payments to offset increasing production costs. In reality, the removal of subsidies further impoverished a large number of farmers. In 2010, the poverty rate reached 30% - three times more than the average in rural areas of the country - in the Al Ghab plain that was once a flagship project of the centralized agricultural policy.

The Orontes basin comprises some of the most conflict-affected areas in Syria today such as the city of Homs and the rural districts of Al Qusayr and Ar Rastan (Haj Asaad and Jaubert 2014). Two-thirds of the four million inhabitants of the basin have been displaced over the past three years. They have taken refuge in areas relatively unaffected by violence, some of which later became combat areas. Many fled, or were forced into exile mostly in Lebanon and Turkey. While some areas are almost empty, in others, the population has more than tripled. Access to safe drinking water is a critical issue for over 2.5 million people and agricultural production has shrunk by over 70%. There is an immediate need to improve drinking water supply and to support agriculture in areas less affected by the fighting. From a post-conflict perspective, the rehabilitation of the domestic and agricultural water infrastructure will be a priority to ensure the sustainable return of displaced populations. Beyond emergency relief interventions, the prioritization and allocation of resources for reconstruction will be determinant factors in the reconciliation process.

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