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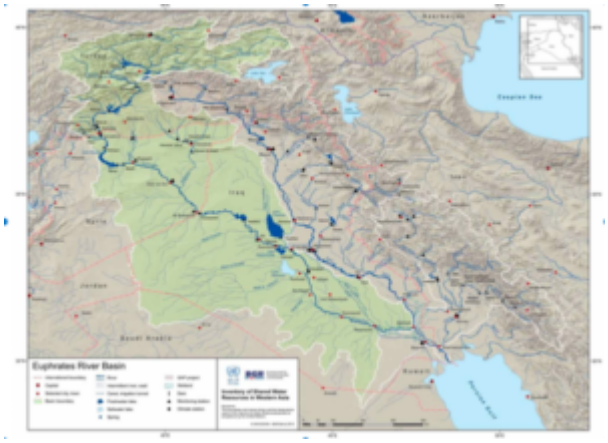

Map of the Euphrates basin. Source: UN-ESCWA (2013, pp. 50–51).

The Euphrates River basin is a transboundary river system divided into three sections: the upstream (Turkey), middle stream (Syria), and downstream (Iraq). The total basin area is 440,000 square km, of which 28% is in Turkey (123,200 square km), 22% in Syria (96,800 square km), and 47% in Iraq (206,800 square km).

The three sections display distinctive features. In the Turkish stretch, the Euphrates crosses a mountainous relief and receives several perennial tributaries until it reaches Syria. Anatolian snow that melts from April to June also contributes to the river.

In the Syrian section i.e. middle stream, the landscape is transitional between the Turkey's cold and Iraq's desert. The river receives just three perennial tributaries and the basin shows an increasing trend towards aridness.

In the lower section in Iraq, the river receives no more contributions from tributaries until its convergence with the river Tigris. Their convergence constitutes a large alluvial delta and this region is subject to regular and intense flooding which increases the evaporation surface. Overall, the basin increases in aridity in Iraq.

The data problem

References to the relationship between decreasing water flow and dam construction in the Euphrates River are commonplace, as is the attribution of increasing salinity to irrigation projects and reservoirs formed by dams[1]. Such assumptions have led to predictions that Iraq will be subjected to drought and salty water, due to an increasing number of Turkish and Syrian dam and irrigation projects.

Yet, data is patchy and selective. For instance, although the *Inventory of Shared Water Resources in Western* Asia by UN-ESCWA[1] considers climate and soil information, it tends to emphasise human impacts particularly dam building. Natural conditions are only treated as vague influences on flow and salinity.

Further, the report regards salinity as 'probably the result of upstream pollution from Turkish irrigation projects, and Syrian agricultural activities in the flood plains of the Euphrates River' (p. 67). Yet, these assertions are based on imprecise data on the quantity and intensity of pollutants and also neglect the effects of natural events, such as rising temperature and evaporation, which can result in higher water conductivity.

In our study, we addressed this discrepancy by demonstrating that natural aspects of the geographical landscape were more strongly associated with the variation of flow (quantity) and salinity (quality) of the Euphrates River than human interventions.

In order to compensate for the lack of substantive data, we employed a blend of quantitative and qualitative analysis. The quantitative analysis was based on a detailed literature review, statistical data, and observational evidence, while the qualitative analysis was based on empirical observation and laboratory results. In this article, we summarise the methodology, findings and, conclusions of our research study.

Methodology

We first analysed the annual discharge data of the Euphrates River, based on three types of information: literature, statistical data and empirical observations. Historical literature did not show evidence of an increase or decrease in flow.

We then examined 41 years (1970 – 2010) of river flow and precipitation data gathered from statistical abstracts and UN-ESCWA[1]. Our statistical analysis revealed that these two variables were more highly correlated than flow and upstream dam constructions. We then compared this data with other sources[1,2,3,4] to test the robustness of our conclusions. We also undertook direct observation of the Euphrates landscape in Syria during three separate field studies.

Next, we analysed the water quality using samples collected from the Turkish-Syrian and Syrian-Iraqian borders to measure levels of salinity. We compared these findings with the results of other studies. Then we examined a set of climate features and geomorphological and hydrological influences that may explain the gradual increase of salinity and a slight diminishing of flow from upstream to downstream. We complemented the analysis with data from the literature, statistics, and with observational evidence in the form of images and fieldwork findings.

Results

Photo of the Euphrates River in the city of Deir Ez-Zor (January 2010). Source: Venturi & Capozzoli 2017.

The statistical analysis of water quantity of the Euphrates River at Jarablus, downstream from all Turkish dams, over 41 years showed that flow is a stationary variable that remains at an approximate average of 778.5 m3/s, despite the many dams constructed over this period. This suggests that the dams do not represent consumptive use except by increasing the evaporation surface. From the year 1970 to 2010, the data series showed peaks and valleys not always coinciding with dam constructions (low correlation) but highly coincident to precipitation rates (high correlation).

Even so, in general terms we did observe a gradual and steady fall in flow downstream. Again, this is not due to the dams, despite their dimensions, as they all have a limit of storage and do not constitute a consumptive use. Similarly, it cannot be attributed to decreasing snowmelt, as this is also found to be constant. Therefore, we related this slight

diminishing flow to climatic factors affecting evaporation rates and levels of precipitation. In addition, we attributed the fall to the natural decrease and eventual absence of tributaries along the length of the river.

While human factors affect the river system, it is not to the extent that sources such as UN-ESCWA[1] seem to suggest (see p.59). Moreover human action follows the natural changes in the river flow, rather than the reverse. This is observed as the river shows an increasing tendency to aridness along the length of the system[5], and so when the flood season is followed by a dry summer, natural seasonal changes in the river result in the demand for irrigation increasing downstream in Iraq, where the river has less water.

Hence, our results led us to conclude that changes in flow are more closely related to natural features than with human interventions. Therefore, although human factors can also be observed to affect the river system, natural features of the Basin are considered to have the greatest effect.

Concerning water quality, laboratory data showed that the quality of the water that enters Syria from Turkey is similar to the water that flows from Syria to Iraq, always with a good level of drinkability apart from an increasing salinity. Our results suggested that this increase in salinity, is due to a higher evaporation rate associated with lower levels of precipitation and perhaps, due to the occurrence of gypsum associated with clay. The natural salinity is confirmed by data gathered prior to dam construction and irrigation projects.

The absence of industrial cities along the Euphrates River and the predominance of traditional agricultural activities contribute to the maintenance of the water quality and negate the likelihood that increased salinity is due to human activities. As a consequence, riparian communities are able to make direct use of the water, as we found during the fieldwork.

Conclusion and policy implications

This article addressed the natural aspects of the Euphrates basin, recognising the natural fragilities and tendencies of the landscape and the role they have to play in the quantity (flow) and quality (salinity) of the water.

We concluded that variation in the Euphrates flow is a seasonal phenomenon more closely associated with natural factors rather than with human interventions. Additionally, we established that while the gradual increase of salinity (towards downstream) was primarily

attributable to natural events rather than the effect of irrigation projects and dams, although human actions could exacerbate this process.

The conclusions drawn here are likely to be relevant to regional water management strategies, which currently appear to focus on engineering and political matters. For instance, recognising how natural dynamics and trends associated with landscape-scale processes shape a river may play a vital role in reducing tension between riparian countries, which is often rooted in claims of human action by a country upstream affecting those downstream.

In the Euphrates region specifically, ensuring that Turkey assures an accorded flow to Syria, and Syria in turn assures the accorded flow to Iraq – while maintaining water quality – is of paramount importance for the region. The findings of this study could open a path contrary to the discourse of water-related conflicts in the region, and could create opportunities for more shared and efficient management.

References:

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