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Science for Environment Policy

Income is key socio-economic influence on urban water use: Spain

Urban water use increases with a population's average income, finds a study of a stressed river basin in Spain. Consumption also increases with population age, but falls as education levels rise. Such information could help municipal water providers predict future water trends and to develop appropriate measures by which to manage demand.There is huge interest in mining polymetallic nodules in deep-sea environments[1]. These bumpy rocks on the seafloor contain highly valuable materials including manganese, iron, cobalt, nickel and copper.

Water is essential to economic development, but water scarcity is becoming increasingly common around the world. In the past century, global water use has increased at twice the rate of population growth. One-third of the world's surface could, therefore, become water-stressed by 2025, leading to increased competition for water between users, such as agriculture, industry and householders.

To help devise water-management solutions that reduce scarcity and competition, it is important to understand the influences on water use. This study is the first to analyse the relationship between urban water use (water used by households and smaller businesses connected to the public water-supply system) and socio-economic factors in a 'closed water body' (a body in which resources for all users are already depleted). The Guadalquivir River Basin is the second-longest river with its entire length in Spain and is mainly located in Andalusia, southern Spain. Currently, urban water use in this area accounts for 15% of total water use (compared to 14% in Spain as a whole). Water used by the agricultural sector represents 82% of total water use in the Guadalquivir river basin (which is higher than the 79.5% national figure).

The study focuses on urban water use in the Guadalquivir River Basin, a river basin representative of the Mediterranean region. Covering an area of over 57 527 km2, the basin includes the cities of Seville, Cordoba and Granada, and accounts for over four million people. The current Guadalquivir River Basin Management Plan, for the period 2015–2021, declares that water consumption has reached its maximum, and that no significant increases in supply are likely in future. However, reallocation between different user-sectors will probably occur in order to cover increasing demands from urban uses, such as household demand, which, within the Spanish Water Act (2001), has priority over agricultural and industrial uses.

The researchers analysed urban water consumption data from the period 2011–2014 for the Guadalquivir River Basin. For each municipality with sufficient data in the river basin, they considered how water use related to a range of potential influences, such as population density, age, educational level, employment, electricity consumption and urbanisation. The study examines all water withdrawals for urban uses, including not only households' everyday consumption, but also urban business and services for all three towns.

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Income is key socio-economic influence on urban water use: Spain *(continued)*

Higher average income levels were a major influence on water consumption. Significantly, there was no evidence of the well-known 'environmental Kuznets curve' (EKC) in this context. The EKC describes an 'upside-down U' pattern in environmental impact (such as water use), whereby impact first increases with economic development but then drops after a certain threshold (e.g. income level) has been reached. This, therefore, indicates that no future drop in water use can be expected in the Guadalquivir River Basin. The researchers say that per-capita water use must be urgently reduced to avoid further shortages that may negatively affect economic development, citizen welfare and the environment. Water uses for the environment have also been depleted in the basin, including those for the Doñana National Park.

In addition, more water will have to be transferred from agriculture to urban uses in future. This has major implications for how the whole basin is managed; for example, it will not be possible to expand irrigated areas, and the efficiency of irrigation schemes must be further improved.

Higher average age of a municipality is a significant factor for higher water use, possibly linked to higher income and spending ability (e.g. on private swimming pools). Increasing competition for water may, therefore, be expected in regions with an ageing population (such as Andalusia). Higher education levels corresponded with lower water use, perhaps because higher education is often related to greater environmental concern.

The researchers add that rising temperatures could be taken into account, though this factor is also correlated to energy consumption (e.g. air conditioning). In the case study, electricity consumption does not play a significant role in explaining water consumption.

Other important influences on consumption were population density and urbanisation. New houses generally increase water demands through both outdoor needs (e.g swimming pools, ponds) and indoor needs (e.g. more water-using appliances). This connection highlights the need to coordinate land-use and water policies, say the researchers. They add that, as the three cities become richer, increasing water use is expected; policy measures to control demand should, therefore, be introduced. Investments should also be made to reduce water conveyance losses (losses from leakage, seepage or evaporation), which currently account for 17% of water withdrawals.

Water-demand policies are particularly important, given that climate change is expected to increase water stress in the Mediterranean through longer and more frequent droughts. The study's findings are applicable to other regions with similar socio-economic and hydrological features.