The water-food nexus and the role of demand management

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Introduction

With the global population projected to reach 9 billion in 2050, demand for food is expected to increase by over 50% in 2030 and 70% in 2050 (UN-Water, 2013). Already agriculture is the largest user of water with irrigation accounting for nearly 70% of all freshwater withdrawals (UN-Water, 2016). It is estimated that to meet this increased demand for food, global agricultural water consumption will increase by around 19% by 2050; however, this figure could be higher if crop yields and the efficiency of agricultural production does not improve dramatically (UNESCO, 2012). At the same time, global demand for water is projected to exceed supply by 40% in 2030 and 55% in 2050 as a result of climate change and non-climatic trends including rapid urbanisation, economic growth and rising income levels, as well as increased demand for energy (OECD, 2012; UNEP, 2016).

Figure 1: Irrigation canal in Algarve, Portugal
Photo Credit: Emmanuel Eragne (via flickr)

Impacts of agriculture on water quantity and quality
Groundwater is used for over 40% of global irrigation on almost 40% of irrigated land and therefore has become an indispensable source of water for agricultural production in many countries. However, groundwater sources are at risk of being 'mined.' In other words, the rate of groundwater extraction is greater than its replenishment rate (OECD, 2016). Meanwhile, agriculture is one of the largest contributors to non-point source pollution impacting rivers, streams and lakes as well as wetlands and groundwater supplies. Fertiliser and animal manure, both rich in nitrogen and phosphorous, are the primary sources of nutrient pollution from agricultural sources. Overall, excess nutrients can cause harmful algal blooms harming public health, creating dead zones in water, increasing water treatment costs and impacting industries dependent on clean water (U.S. EPA, 2016a, 2016b).

Demand management
To reduce water-food nexus pressures, water managers can implement demand management strategies to balance rising demand for limited, and often variable, supplies of good quality water. Demand management involves the better use of existing water supplies before plans are made to further increase water supply. Demand management promotes water conservation, both during times of normal conditions and uncertainty, through changes in practices, culture, and people's attitudes towards water resources (Brears, 2016). Demand management aims to: reduce loss and misuse; optimize water use by ensuring reasonable allocation between various users while considering downstream users, both human and natural; facilitate major financial and infrastructural savings; reduce stress on water resources by reducing unsustainable consumption levels; and reduce water quality degradation.

Case 1: Irrigation tariff simulator in Portugal

The Alqueva Multi-purpose Undertaking (EFMA) in southern Portugal is Europe's largest irrigation project. Around 120,000 hectares of irrigation area has been set up in a region where soils are highly suitable for irriga-

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tion and the number of hours of sunshine is above the European average (EDIA, 2016b). As part of EFMA, irrigators are offered a tool for simulating water consumption and estimating its cost. The irrigation tariff simulator calculates the cost of water consumption based on the location and type of supply, year of introduction of the crop, amount of crop expected and the area covered (EDIA, 2016a).

Case 2: Water quality trading in the Ohio River Basin

The Ohio River Basin Water Quality Trading Pilot Project is a first-of-its-kind interstate program that spans Ohio, Indiana and Kentucky to evaluate the use of trading by industries, utilities, farmers and others to meet water quality goals while minimising costs. The water quality trading program, a market-based approach to achieving water quality goals, allows permitted discharges to generate or purchase pollution reduction credits from another source (EPRI, 2015).

Conclusions

With the global population increasing over the coming decades, demand for food is expected to increase significantly. This will lead to increased demand for water in food production. At the same time, global demand for water is projected to exceed supply due to climate change and non-climatic trends including rapid urbanisation, economic growth and rising income levels, as well as increased demand for energy. To reduce water-food nexus pressures, water managers can use demand management tools to reduce water demand and promote efficiency through water tariffs, while at the same time reduce agricultural impacts on water quality through activities including water quality trading.

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