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Improving the hydro-ecological status of streams in water stressed environments by integrated water management approach

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Treated wastewater becomes an important component of the water cycle in arid and semi-arid regions, and it serves as an attractive substitute to freshwater for irrigation. However, despite the increased reuse of treated wastewater and alternative water resources development (e.g., desalination), it is commonly observed that the increasing demand for freshwater resulted in excess pumping and the dry out of many stream ecosystems. Israel serves as a unique example where today more than 80% of the total domestic sewage is reused for irrigation and 50% of its freshwater is desalinated seawater, but despite all these efforts the hydro-ecological status of most coastal streams in Israel is still poor.

Recent case studies in the US suggested that reusing treated wastewater for stream flow augmentation could regain some of the stream ecosystems services. However, the experience from reusing treated wastewater for stream augmentation in the Yarqon stream (Israel) during the last decade revealed that further actions are needed to improve the hydro-ecological status of streams in water stressed environments. Such actions require an integrated water management approach that involves: pollution prevention, improved water treatment, water reuse, water allocations, re-vegetation and in-stream manipulations.

In this talk, we will present results from a long-term effort for rehabilitation of the Yarqon Stream using an integrated water management approach. Water allocations and augmentation increased the flow rate in the upper section of the stream from zero to 1000 m^3/h with water from the aquifer. Further downstream, secondary level effluents were replaced by tertiary level effluents polished in treatment wetlands, and added additional 1,300 m^3/h to the stream. In addition, pollution prevention infrastructure has affectively reduced peak events of contamination from diffuse and point sources along the stream, especially following rain events after long dry periods. The aforementioned actions have led to improvement in water quality of the stream but only partially to the ability of the stream to uptake nutrients and organic contaminants. Invertebrate community in the impacted section of the stream has recovered and is now similar to the upstream section of the Yarqon, above the treated wastewater input. Finally, fish that were absent from many sections of the stream are now observed along the entire augmented section, including the endemic near-extinct species, *Acanthobrama telavivensis*. The near future plans for additional water treatment and water trading is expected to further improve the hydro-ecological status of the Stream, and will also be discussed during this talk. The case study of the Yarqon serves as a unique situation of stream rehabilitation in semi-arid climate and the lessons learnt in the last decade could serve for developing rehabilitation programs in other catchments especially in the Mediterranean region.