Applicability of Managed Aquifer Recharge to achieve the goals of sustainable development facing climate change in semi-arid regions (Southern Spain)

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In 2015, "The Sustainable Development Goals" (SDGs) were adopted by the United Nations as a call to action to protect the planet and natural resources. SDG number six deals with guarantee the availability of water and its sustainable management by 2030. Some of the main problems in water management are the decreasing annual rainfall and the expected rise of rainfall intensity and evaporation rate as a consequence of climate change, together with the growth of water demand. All that is particularly alarming in semi-arid regions and other domains, like the Mediterranean area, where water resources are very often dramatically stressed. In this scenario, Managed Aquifer Recharge (MAR) is considered an increasingly important water management strategy to enhance the quantity and quality of groundwater as a key step towards achieving the SDGs.

The selection of MAR techniques and the effectiveness of their design and implementation require a complete understanding of the physical/hydrogeological framework. This must include the definition of aquifer geometry and limits to estimate storage capacity, the assessment of hydraulic properties, the quantification of the groundwater budget, the establishment of reliable hydrogeological conceptual and numerical model, and the groundwater quality monitoring. Besides, the availability of water to be recharged is crucial. Many regions use stormwater (Perth, Australia) and wastewater (Alberta, Canada) to recharge aquifers via infiltration basins or wells and subsequently reuse this water for drinking use or irrigation purposes. Finally, social and economic drivers must also be taken into account.

The present contribution synthesises a series of previous experiences carried out in Southern Spain involving the Centre of Hydrogeology of the University of Malaga (CEHIUMA): a wetland restoration in the alluvial formation of the Guadalhorce River Mouth (Malaga) using wastewater, a pilot trial in the semi-confined aquifer of Niebla-Posadas (Guadalquivir basin) to recharge dammed water surplus and increase the resilience of the supply system of a large city (Seville), and two experiences in the overexploited coastal detrital aquifers of Marbella (Malaga) using surface water from an overflow karst spring and recycled wastewater through wells and infiltration ponds, respectively.

All these experiences demonstrate the feasibility of MAR applications in water-stressed areas as Southern Spain, but also its transferability to climatically similar areas to ensure water availaibility, improving sustainable water management and environmental restoration in line with the SDGs of the proposed 2030 horizon. However, it is also necessary to emphasise the importance of combining correct site selection, a rigorous hydrogeology background knowledge, a good selection of the water source for recharge and a site-specific design the most compliant MAR facilities.