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How irrigation good practices can put under pressure the groundwater system of the Bacchiglione Basin (Italy)

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In the coming years, water resource management will become more and more important for satisfying competing water-related needs under the pressure of water scarcity and climate change. The choice of how to allocate water is difficult, uncertain, and context specific. This study aims to bring to the fore a significant example of sustainability of groundwater system management under specific requirements and dependence on irrigation activities. The groundwater system at hand is the Bacchiglione basin, near Vicenza (Veneto, Italy), an essential water asset for local ecosystems, human needs and economic activities. Its recharge mainly happens in the northern unconfined portion by three factors: river seepage, rain and irrigation infiltrations.

Historically, the contribution of irrigation practices has been fundamental for recharging the hydrogeological system. However, local irrigation authorities have begun to replace traditional irrigation techniques, such as the field overflow or draining channels, with more innovative techniques, such as piping grids with sprinkling devices. The shift towards more efficient methodologies, whose main goal is to save water, puts under pressure the local groundwater system because of the reduced artificial recharge.

Currently, the present irrigation network, techniques and activity schedule yields an overall annual irrigation contribution of approximately 5.4 m³/s, about the 25% of the total inflow at the basin scale. This flow is expected to decrease in the future. By modelling the system (via FEFLOW), this study concerns possible scenarios by changing the irrigation technique. As an example, all currently overflowed fields are converted to sprinkling irrigation. This technical change leads to an estimated inflow decrease of 1.6 m³/s during the irrigation period between May and August, without considering the consequent decreased dispersion by distribution channels. This scenario highlighted an area particularly affected by a piezometric drawdown which is of particular interest because in the district many wells for the public supply authorities are located.

Our study confirms irrigation as an important recharging factor within the Bacchiglione basin. The project of making agriculture more efficient with 'good practices' involves in this specific case a lowering groundwater level, comparable to climate change and land use change effects. To counteract such resource depletion, local irrigation authorities have already tested managed aquifer recharge measures, like e.g. forested infiltration areas. To be effective, however, such

interventions should be planned at larger spatial scales to grant adequate long-term effects. Moreover, the present work suggests to keep active irrigation channels in winter months to increase seepage and also to sustain local habitats and ecosystems and maintain the rural landscape.