

MAR to Mitigate Intensive Aquifer Exploitation

Insights From Los Arenales Aquifer (Spain)



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BACKGROUND

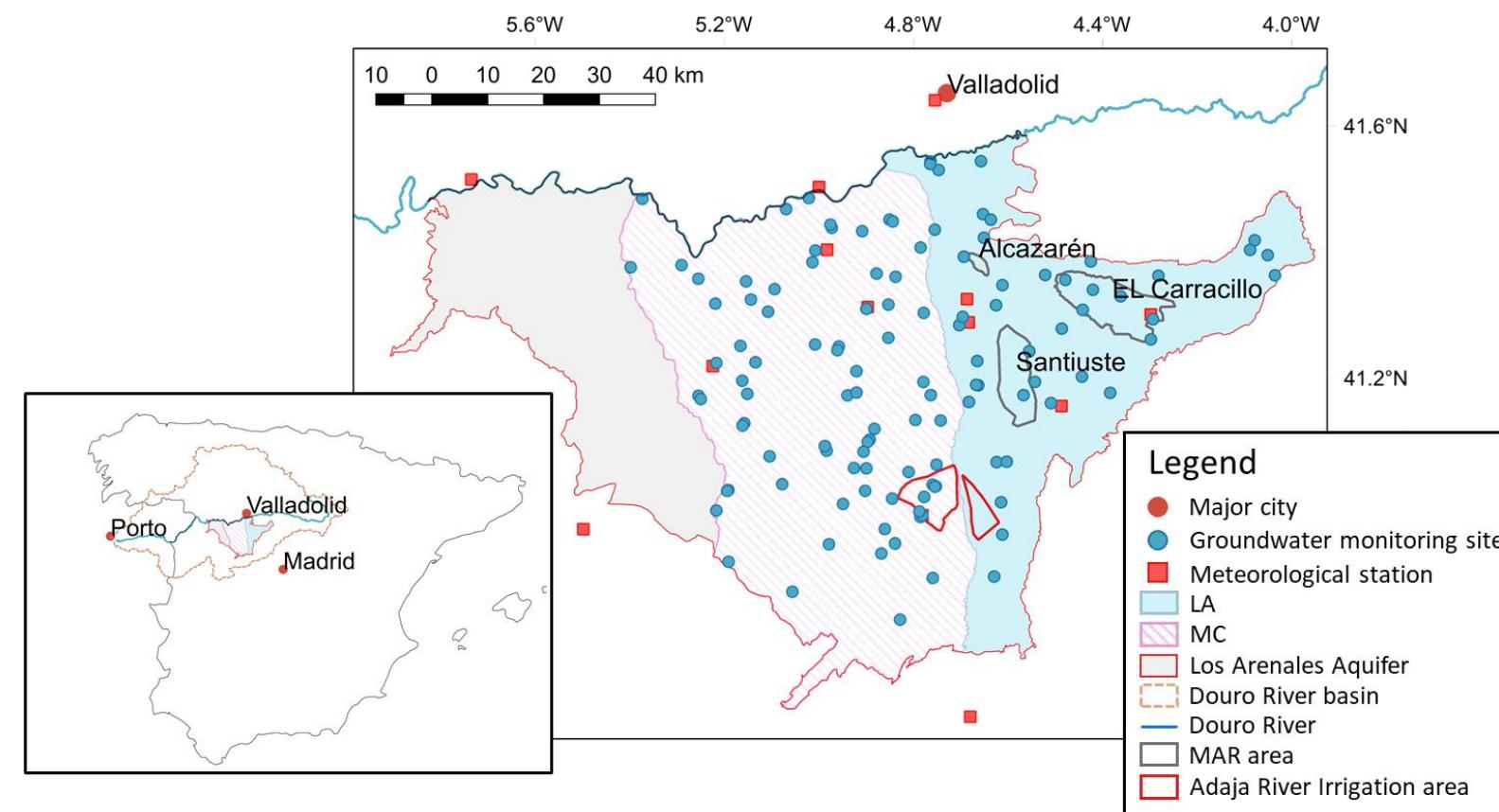
Los Arenales Aquifer has been intensively exploited for agricultural irrigation since the second half of the 20th century (up to -1.1 m/year)

OBJECTIVE

Evaluate if managed aquifer recharge (MAR) has helped palliate groundwater stress in Los Arenales Aquifer

METHODS

Compared groundwater level evolution between two water management regions within Los Arenales Aquifer: Los Arenales (LA) (implemented MAR in 2002) and Medina del Campo (MC) (No MAR before 2020)

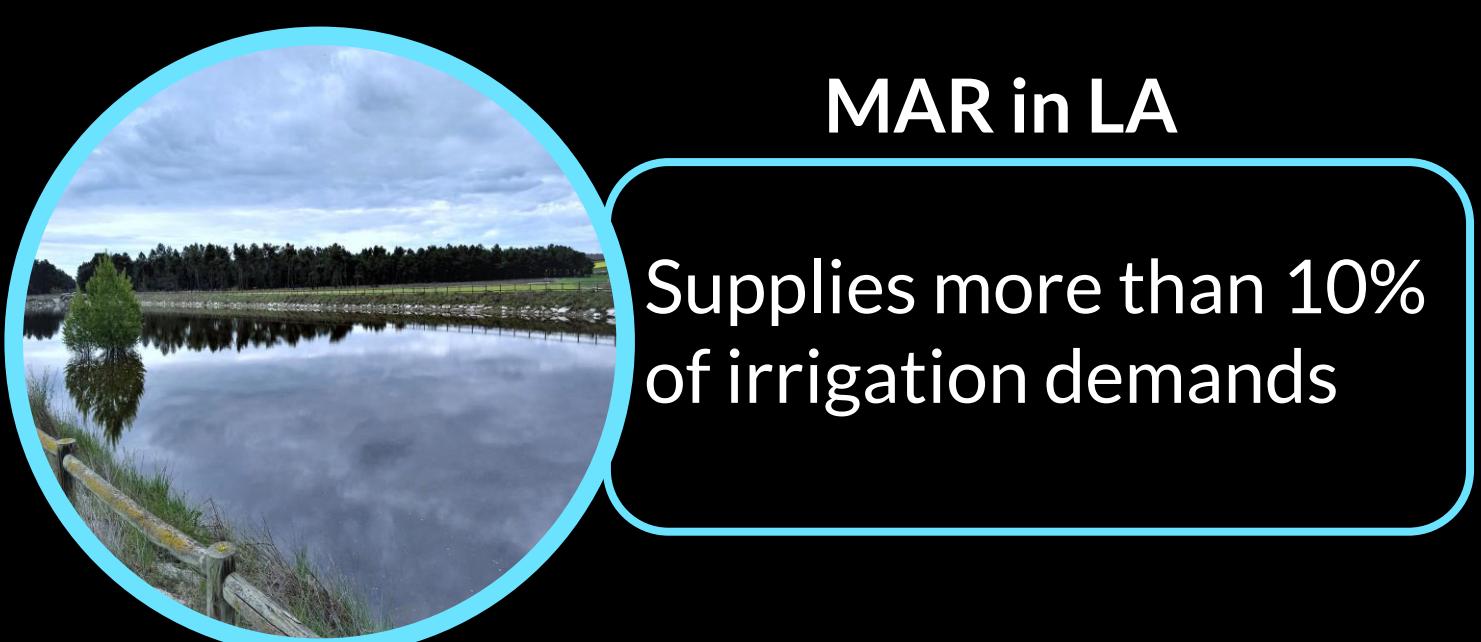
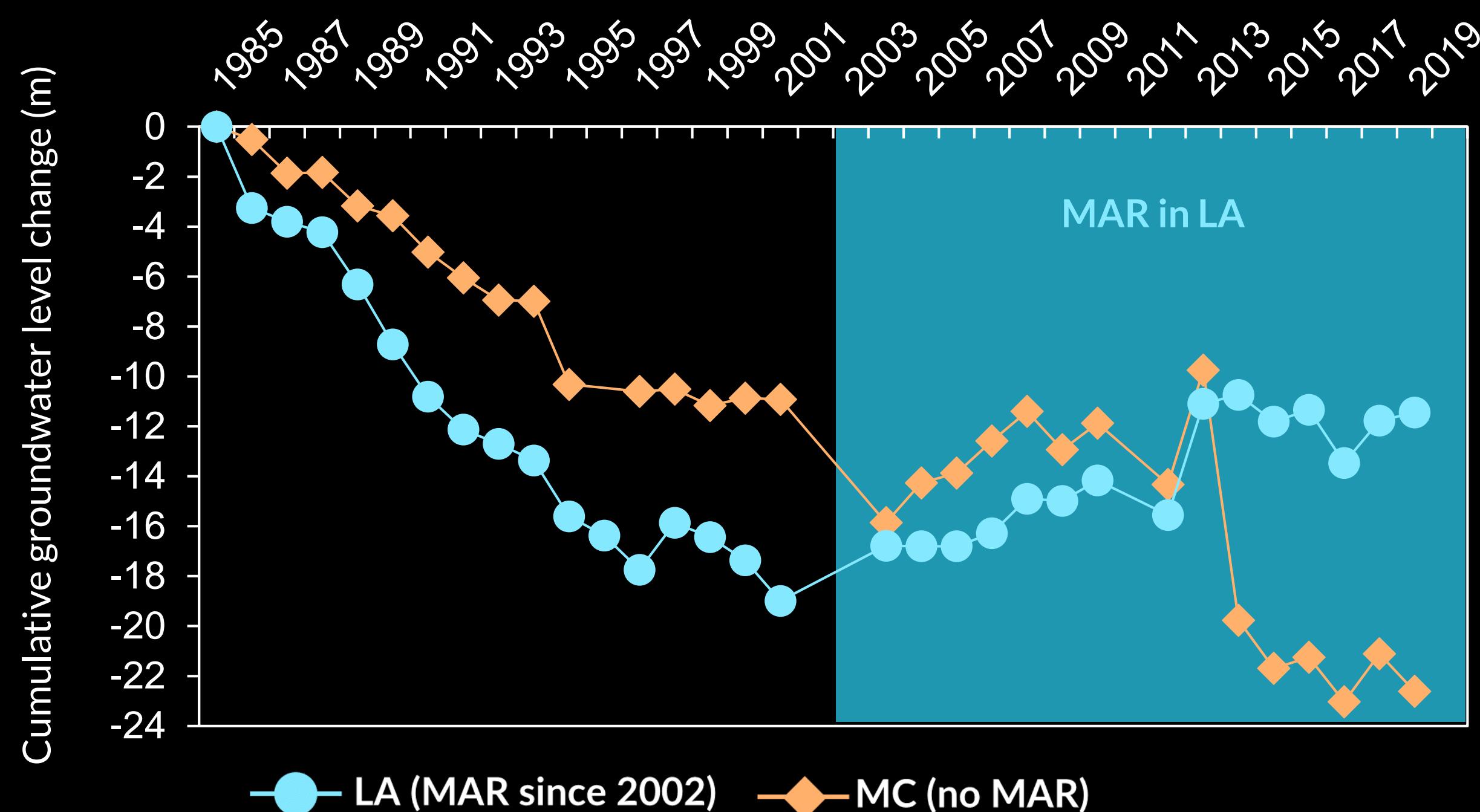


Analysis of groundwater level trends and variables that could explain the observed changes in groundwater levels: MAR, groundwater abstractions, land use, cropping patterns, and water governance dynamics

MAR in LA: three major areas (Santiuste, El Carracillo and Alcazarén)

- Main water source: winter river surpluses
- 21 infiltration basins
- ~50 km of infiltration channels
- Six artificial wetlands (improve water quality)

MAR contributes replenishing stressed aquifers thanks to additional recharge and water governance dynamics



MAR irrigation communities

- Cooperate to control water demand
- Ease innovation to cope with dry years, avoiding groundwater overdraft



RESULTS

From 1985 to 2001, ~100% of statistically significant groundwater level trends decrease in LA and MC. From 2012 to 2020, ~75% of the trends in LA are increasing, while ~75% of the trends in MC are decreasing

MAR provides at least 10% of irrigation demands in LA. Annual groundwater abstractions in LA are below recharge + returns since at least 2009, reflecting more control on water demand. No relevant changes in land use or cropping patterns were found

Water governance dynamics:

Two irrigation communities (gather farmers exploiting a common water source) created in LA to benefit from MAR. These communities foster:

- Direct communication with the local water authorities
- Negotiation of water rights (abstractions)
- Information transfer

The lack of irrigation communities in MC results in:

- Farmers acting on their own
- More illegal abstractions
- Less influence of the local water authority to introduce innovation, transfer knowledge, and control demand (Giordano et al., 2021)

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- Giordano, R., Márquez Costa, M., Pagano, A., Mayor Rodríguez, B., Zorrilla-Miras, P., Gómez, E., López-Gunn, E., 2021. Combining social network analysis and agent-based model for enabling nature-based solution implementation: The case of Medina del Campo (Spain). Science of The Total Environment 801, 149734.

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