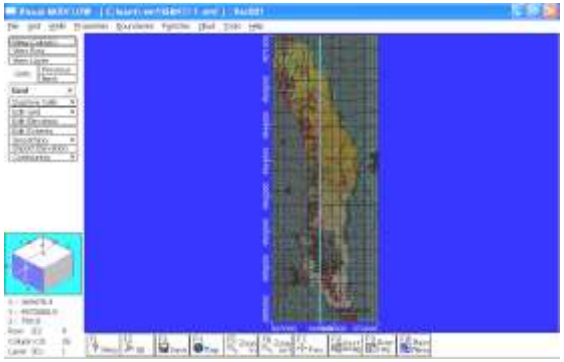
THEME 2

How can managing water in agriculture contribute to food security and public health?



Industrial and environmental Managed Aquifer Recharge-related water security cases contributing to food safety and public health

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MARSoluT Managed Aquifer Recharge ITN

Tragsa GrupoTragsa

International Association of Hydrogeologists the World-wide Groundwater Organization

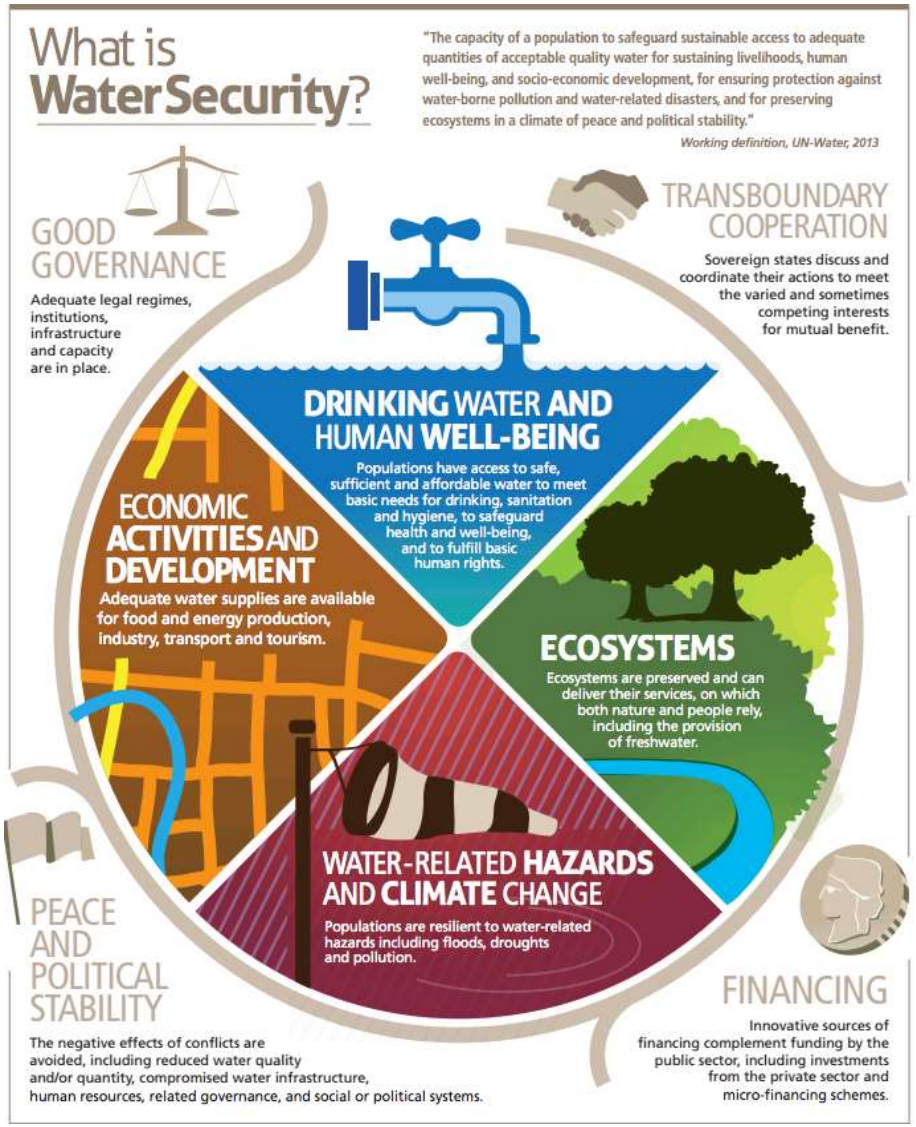
IAH Commission on Managed Aquifer Recharge

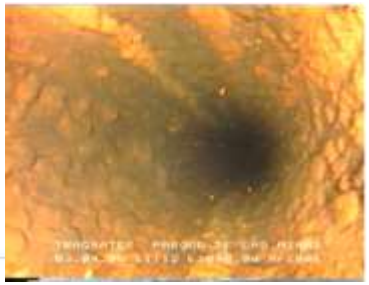
Introduction

-Selected Spanish **MAR-related industrial and environmental cases** have been studied, tracking some indicators´ evolution… **to check whether or not MAR is a key element** for human wellbeing, socio-economic development, …, food safety and public health

-Socio-economic success is dependent on water availability, water preservation and MAR (to a certain extent)

-The next selected areas have included **MAR in** their **IWRM schemes to increase their resilience & to improve their governance schemes.**

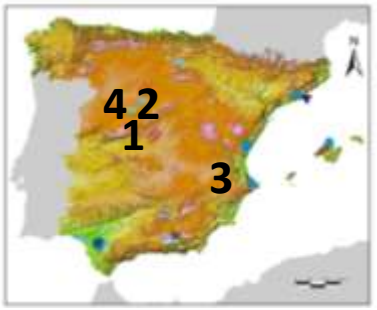




Water security and MAR

Industrial water security

Environmental water security



MAR as an IWRM component:

-MAR guarantees environmental water security

-MAR is a climate change adaptation measure

-MAR in an irrigation area > contributes to food safety

Use-cases

1- Evolution of socio-economic indicators in a rural area where MAR is applied since 2002 (Segovia)

2- Water security related to water quality evolution and measures for preservation (Valladolid)

3- MAR is used to decrease the flood´s devastation effect on crops and food production (Valencia)

4- MAR to reduce the disturbing presence of water in agricultural areas with drainage problems affecting food production (Salamanca).

1

2

3

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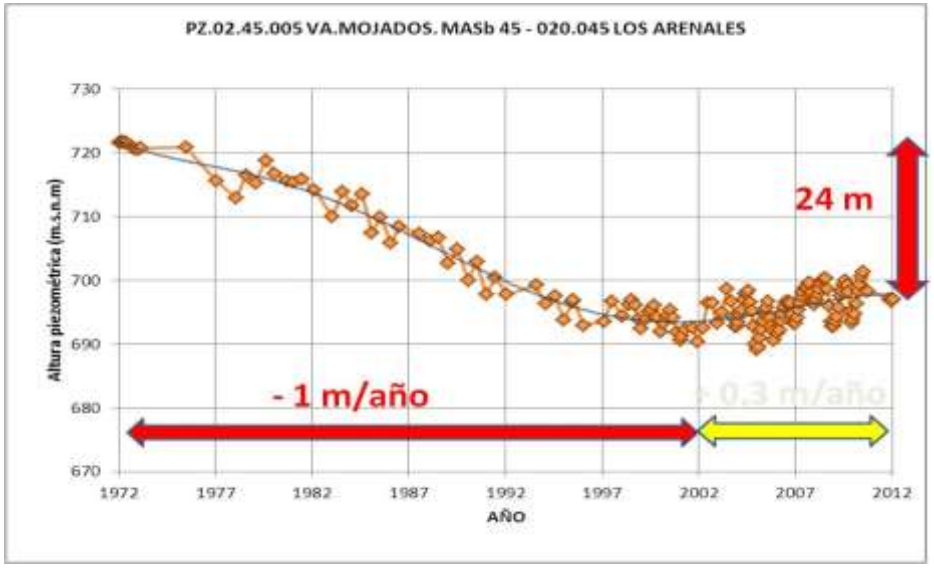
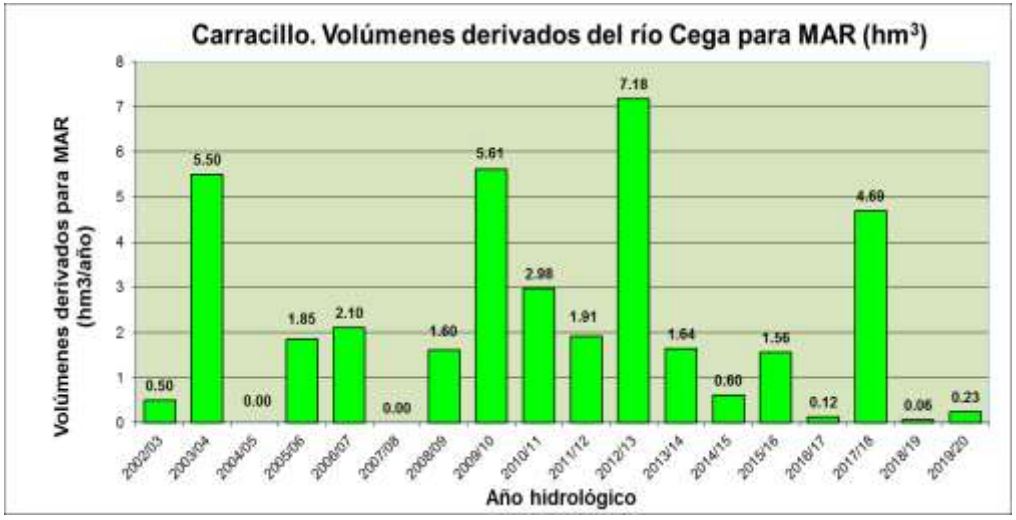
El Carracillo, Los Arenales, Segovia, Spain

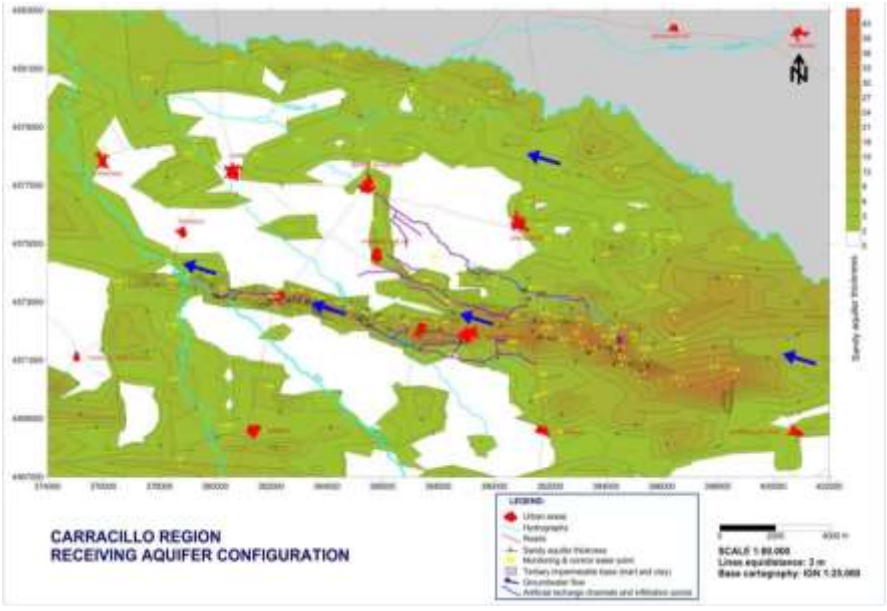
1- Evolution of socio-economic indicators in a rural area where MAR is applied since 2002 (Segovia)



LOS ARENALES

- Groundwater level evolution:
  - -1 m/year (1972-2002)
  - +0.24 cm/year (2002-2020)





0.00 to 7.18 MCM

Q_m =2.19 MCM / year

Indicator: evolution of the GW storage

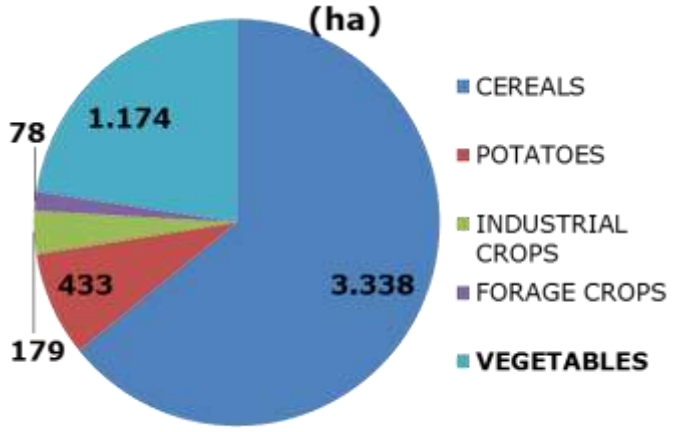
Socioeconomy in El Carracillo Shield

Driving force of the local economy

- **3,500 ha in irrigation / 7,586 ha**
- **80% of vegetables production of the province**
- **GW extraction about 8 MCM/year (314.3 m^3/ha)**
- **24% of irrigation water comes from MAR**

E.g. food production, employment creation, percentage of MAR water used in agriculture

Crops distribution

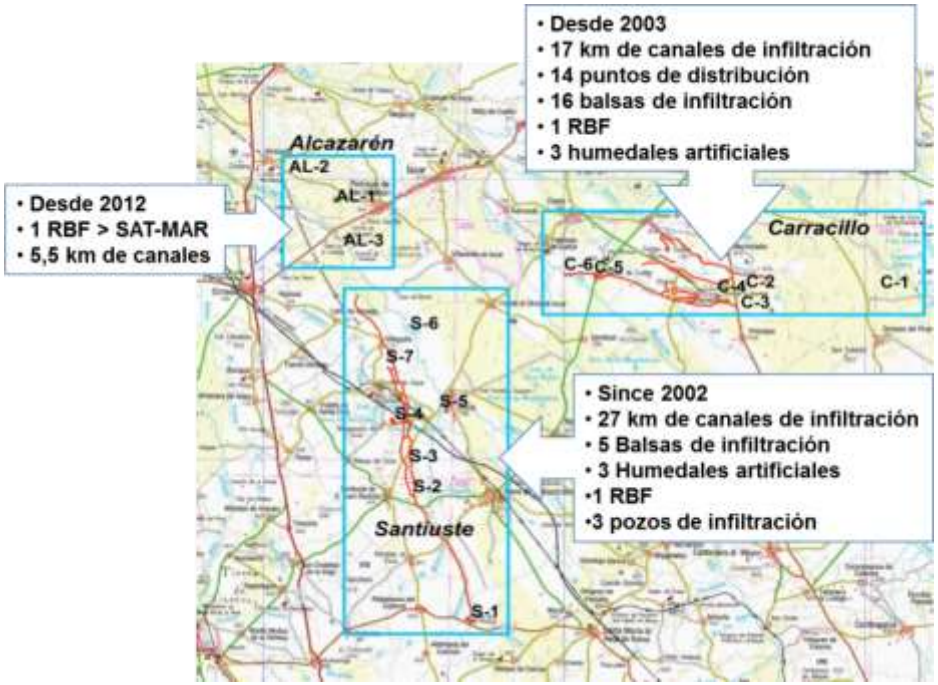


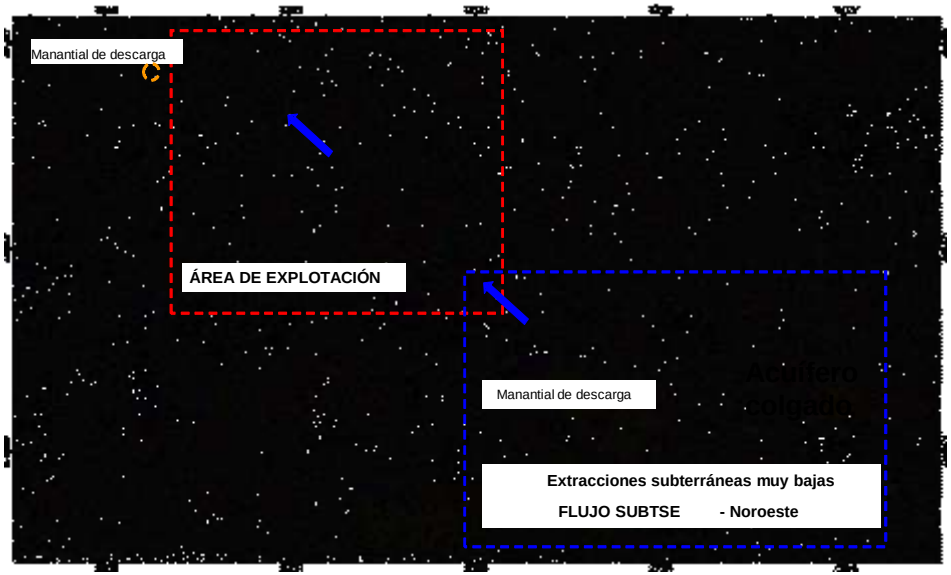
Economic indicators

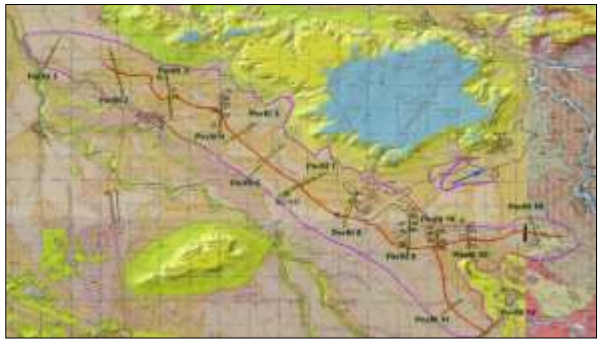
- **EMPLOYMENT:**
  X3 in respect to the region
- **POPULATION:**
  Rised about 6% since 2000
- **PRODUCTIVITY**
  Duplicated / Triplicated

Alcazarén-Pedrajas SAT-MAR (Los Arenales) Valladolid

2-Water quality variations depending on the wise mixture of different origin water resources, with stakeholders´ intervention (Co-MAR)







Aquifer area: 23 x 2.5 km²

PROBLEM: Intensive GW exploitation.
GW table declined 15 m in 30 years

SOLUTION: 2012 NEW (SAT-)MAR experience to guarantee **the aquifer sustainability, irrigation and agroindustry**

Water sources diversification

Novelty: Three different water sources for MAR

PIRÓN RIVER

PEDRAJAS VILLAGE RUNOFF ROOF-TOP WATER > > MAR CHANNEL

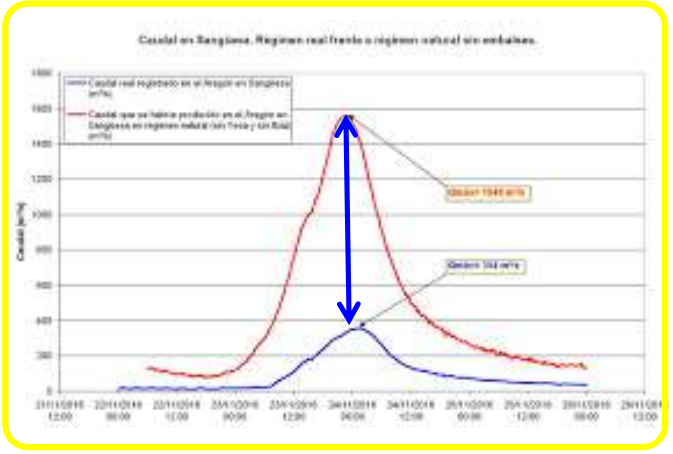
ADVANCED SECONDARY WWTP

- **Operativity independent from surpluses and allowances**
- ***"Dilution as a solution to pollution"***
- **Post-treatment actions (interactive filters)**
- ***Nature Based Solutions* (aquifer as purification element)**
- Natural, passive and economic actions
- **Reuse of water with security (circular economy)**
- **TOC increase > disinfection actions**
- **Long term applicable technologies.**

3- MAR to decrease the flood´s devastation effect on crops and food production, Lliria (Valencia)

Deep MAR borehole from an irrigation pond (flood MAR and water security)

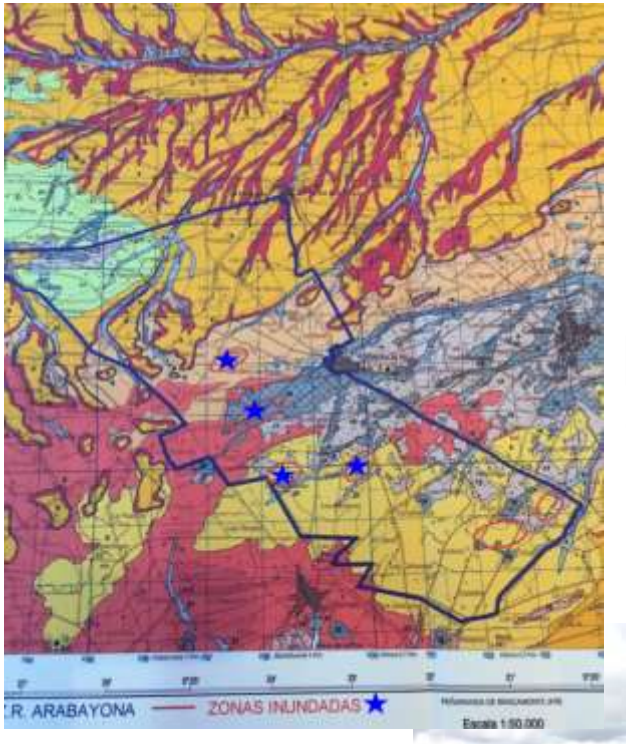
- MAR flow rate during a flood (>100 l /s)
- Flood peak reduction
- Devastation reduction *(divide et impera)*

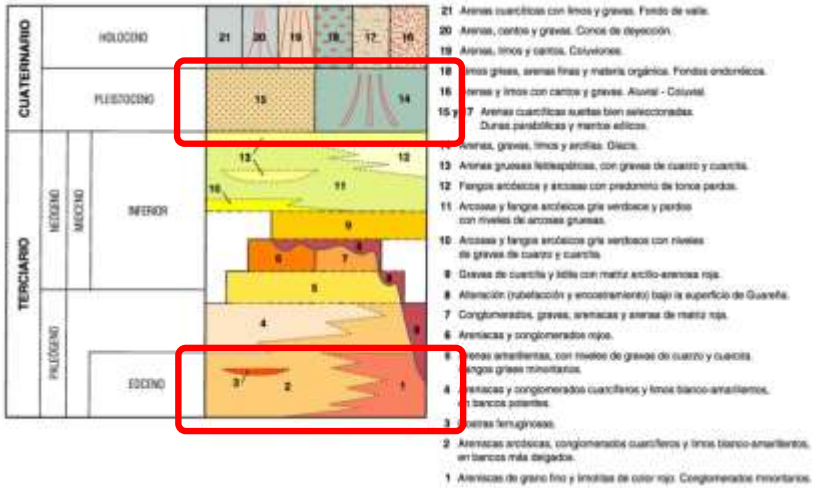


INDICATOR: Amount of water detracted from a flood and rapidly converted into groundwater (~ 0.05 MCM/event)

Arabayona, Salamanca, Spain

4- MAR to reduce the disturbing presence of water in agricultural areas with drainage problems affecting food production





-Natural situation and MAR as a complementary technology for aquifer storage using a fraction of "nuisance" surface water

-Food production is resulting increased

-Nitrates impact

Indicator: balance surface water-GW storage

Results

In general, the application of MAR technique in the selected IWRM schemes are:

1- Impacting on irrigation areas, e.g.:

Rise of the population about 6% since the year 2000

Triplicating the production of certain crops …

2- The reuse of water is key for food production (MAR & NBS are improving water quality in, at least, 17 parameters and GW availability)

3- The amount of water detracted from floods is about 0.05 MMC in each event

4- Drainage areas with MAR present high nitrates concentration but food production is increased.

Suelos

Permeabilidad

Zonificación del medio receptor por Unidades homogéneas

Ensayos hidráulicos

Conclusions

1. MAR in IWRM schemes should prioritize urban water supply as main water security objective
2. Intermittent MAR systems cannot guarantee a permanent application of MAR, therefore water security has a higher degree of uncertainty
3. SAT-MAR cases (24-7 MAR) increase water security, but water quality evolution must be permanently monitored
4. Solutions might be achieved in bottom-up approaches into multi-level governance organizational schemes and spaces of collaboration, involving, at least, water authorities and stakeholders
5. Water security very often depends on (or is jeopardized by) economic interests
6. Regulation barriers and conflicts of interest hamper MAR
7. Multi-level governance, bottom-up DSSs, Co-Managed Aquifer Recharge (Co-MAR) & People Public Private Partnerships (PPPP) are improving IWRM, water security, food safety and public health.

Additional information

International Association of Hydrogeologists
the World-wide Groundwater Organisation
IAH Commission on Managed Aquifer Recharge

IAH-MAR Managing Aquifer Recharge Commission

https://recharge.iah.org/

IAH Commission on Managing Aquifer Recharge

International Association of Hydrogeologists

WELCOME | ABOUT THE COMMISSION | SYMPOSIA AND WORKSHOPS | WORKING GROUPS | COMMUNITIES | COLLABORATIONS | RESOURCES

Welcome

Attendees at ISMAR10, Madrid, May 2019 – the latest triennial symposium of IAH-MAR, UNESCO and ASCE

Welcome to the website of the International Association of Hydrogeologists Commission on Managing Aquifer Recharge (IAH-MAR). Here you can discover what our working groups are doing and contribute to their current projects, you can download resources on MAR, connect with people, get information on symposia coming up, and join our email list to stay informed of latest news. We also have sister sites in Spanish and Chinese.

Managed Aquifer Recharge

Managed aquifer recharge, also called groundwater replenishment, water banking and artificial recharge, is the purposeful recharge of water to aquifers for subsequent recovery or environmental benefit. It embraces methods such as riverbank filtration, stream bed weirs, infiltration ponds and injection wells, and uses natural water sources and appropriately treated urban stormwater, sewage and other waste waters to increase groundwater storage, protect and improve water quality,and secure drought and emergency supplies. Its growing scientific base supports its rapidly increasing use as a vital management tool in the sustainable use of the world's water resources.

Latest News

CURRENT PROJECTS THAT YOU CAN JOIN

- New working group: MAR in Conferences. Coordinator: Daniela Benedicto van Dalen
- New working group: Urban MAR. Coordinator: Niels Hartog
- LatinMAR Community of Practice – a new initiative to advance MAR in Latin America. Coordinator: Adriana Palma
- MAR Suitability Mapping Working Group. Coordinator: Jose Bonilla
- Contributions to a second monograph on clogging-focussing on its management – Clogging Working Group. Coordinator: Russell Martin
- Groundwater Solutions Initiative for Policy and Practice (GRIPP) – a Collaborative International Project, Coordinator: Karen Villholth

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https://lists.flinders.edu.au/mailman/listinfo/iah-mar.listcgs