

## International Association of Hydrogeologists Commission on Managing Aquifer Recharge

#### Report of activities in 2020

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## Aims of the Commission

- The Commission promotes the securing and expanding of water resources and improving water quality in ways that are appropriate, environmentally sustainable, technically viable, economic and socially desirable.
- It encourages research, development and adoption of improved practices for management of aquifer recharge and improving knowledge, skills and capabilities of practitioners, water resources managers and regulators.
- It facilitates international exchange of information between members (e.g. via a web page and an email list), by disseminating results of research and practical experience (e.g. via conferences and workshops), raising awareness of MAR among IAH members, related professions and the community, and its members undertaking projects and activities identified in plenaries as important.
- Aligns with UNESCO IHP-VIII (2014-2021), Water security: responses to local, regional, and global challenges", strategic plan, Focal Area 2.2 Addressing strategies for management of aquifers recharge

IAH Commission on Managing Aquifer Recharge



WELCOME

ABOUT THE COMMISSION

**EVENTS** 

**WORKING GROUPS** 

COMMUNITIES

COLLABORATIONS

RESOURCES

ISMAR

#### 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 Aguifer 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.

Screenshot pf IAH-MAR Commission website (https://recharge.iah.org)

## 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 cloggingfocussing on its management – Clogging Working Group. Coordinator: Russell Martin
- Groundwater Solutions Initiative for Policy and Practice (GRIPP) a Collaborative International Project, Coordinator: Karen Villholth

## Working Groups and Communities of Practice

The work of the IAH-MAR Commission is organised in several Working Groups (WGs) and Communities of Practice (CoP).

#### Working Groups

Working groups have evolved out of ideas raised by attendees of IAH-MAR Plenary Meetings to advance knowledge of MAR in areas considered important to improved knowledge, reliability, information, communication and wise uptake of MAR. The current working groups of the IAH-MAR Commission include the following:

#### **MAR for Sustainable Development**

https://recharge.iah.org/working-groups/mar-for-sustainable-development Yan Zheng (SUSTech, PR China)

Initiated in the IAH MAR Plenary at ISMAR8, Beijing Oct 2013, the MAR for Development group aims to advance the policies and practice of MAR in developing countries by sharing relevant information. The aims expanded to include sustainable development through exchange of experiences between developing and developed countries. In 2020, the group leader and Commission co-chair Yan Zheng continued working on the release of the UNESCO publication on MAR "Managing Aquifer Recharge: A Showcase for Resilience and Sustainability" (the book was expected to be released during World Water Week 2020 but was postponed to 2021 due to pandemic).

#### **Economics of MAR**

https://recharge.iah.org/working-groups/economics-of-mar Andrew Ross (ANU, Australia)

The objectives of the group are to document the financial costs and economics of MAR in relation to alternative water supplies or storages, to provide information on the value of investing in MAR, and to identify scenarios where MAR may produce the least cost water supply. An economic and financial analysis of MAR case studies was included in the upcoming UNESCO book, Andrew being one of the co-editors of the book. Further involvement includes contributions to a research proposal of TU Dresden led by Catalin Stefan on the economic valuation of MAR contribution to ecosystem services.

#### Monograph on clogging and its management

https://recharge.iah.org/working-groups/clogging-and-its-management Russell Martin (WGA Pty Ltd, Australia)

A second book on MAR clogging is in preparation, planned to be released during ISMAR10 but postponed possibly to ISMAR11. A first monograph was produced between 2010 and 2013 and included a compilation of case studies on 212 pages.

Download the full PDF here: <a href="https://recharge.iah.org/files/2015/03/Clogging">https://recharge.iah.org/files/2015/03/Clogging</a> Monograph.pdf.

#### MAR water quality guidance and regulations

https://recharge.iah.org/working-groups/mar-regulations
Manuel Sapiano (Malta Energy and Water Agency)

The group aims to assemble access to known policies, regulations and guidelines on the IAH-MAR website, together with any commentaries on these, and subsequently produce a critical review that would be useful for jurisdictions needing to develop such policies. The first outcomes are already available on the working group website (see link above). Furthermore, Manuel drafted a Guidance Document on Managed Aquifer Recharge as part of Common Implementation Strategy (CIS) of European Commission for the Water Framework Directive. The draft document is currently being reviewed by EU Member States with further debates and improvements planned in 2021. Noteworthy is also the recent paper:

Fernández Escalante, E., Henao Casas, J., Vidal Medeiros, A., San Sebastián Sauto, J. (2020). Regulations and guidelines on water quality requirements for Managed Aquifer Recharge. International comparison. Acque Sotterranee - Italian Journal of Groundwater. 9. <a href="https://doi.org/10.7343/as-2020-462">https://doi.org/10.7343/as-2020-462</a>.

#### MAR suitability mapping

https://recharge.iah.org/working-groups/mar-suitability-mapping
José Bonilla (AyA, Costa Rica) and Catalin Stefan (TU Dresden, Germany)

The aim of the working group is to identify, discuss and evaluate the range of methods used for mapping MAR suitability. The group published several papers and a report as result of a workshop held during ISMAR10 in Madrid, Spain. The activities continued in 2020 by publication of further articles by various IAH members and MAR community.

#### MAR in conferences (NEW in 2020)

https://recharge.iah.org/working-groups/mar-co

Daniela Benedicto van Dalen (Acacia Water, The Netherlands) and IAH MAR Commission cochairs, plus future local members

The Working Group "MAR at Conferences" (MAR-CO) was created in 2020 to assist conference organizers worldwide with the integration of MAR into the conference programmes. Whenever possible, a dedicated session is proposed, together with additional events and side activities. For 2020, the MAR-CO WG aimed to call attention to MAR during the upcoming 47th IAH Congress in Sao Paulo, Brazil. Overall, the initiative aims to share knowledge and best practices on MAR with local professionals and governmental institutions in Brazil, to create awareness of the benefits and importance of MAR, network with the Latin American community during the congress and foster new ideas for future cooperation and pilot projects.

For future conferences we seek to find more volunteers willing to provide assistance to conference organizers in order to increase the presence of MAR in the conference programmes.

#### Urban MAR (NEW in 2020)

https://recharge.iah.org/working-groups/urban-mar

Niels Hartog (KWR, the Netherlands)

This Urban MAR working group aims to exchange information and cooperate in the development of technical and non-technical aspects for the successful application of urban MAR and to showcase successful practical examples. To foster and develop the application of urban MAR, it is proposed to develop a position paper on the conditions, requirements and benefits of using urban MAR in cities. The aim is to present a (first draft) position paper at the MAR commission meeting at the 2020 IAH conference in Sao Paolo, Brazil.

The following steps are proposed to come to a position paper on urban MAR:

- 1. Collection of "Urban MAR" example summaries (1-2 pages, standardized format)
- 2. Thought development on what defines urban MAR and how it can contribute to more healthy and sustainable cities
- 3. Develop a perspective on how the conditions and goals for successful urban MAR application depending on local and regional, hydrogeological, economic and governmental conditions.
- 4. Write globally oriented draft position paper on potential and application of urban MAR

Working groups closed in 2019 but partially still active:

#### 60 years history of MAR

https://recharge.iah.org/working-groups/60-years-history-mar

Peter Dillon (CSIRO, NCGRT, WGA Australia) and Pieter Stuyfzand (KWR & TU Delft, NL)

#### MAR to MARk€t

https://recharge.iah.org/working-groups/mar-to-market

Enrique Fernández Escalante (Tragsa, Spain)

#### Global MAR Inventory

https://recharge.iah.org/working-groups/global-mar-inventory

Catalin Stefan (TU Dresden, Germany) and Arnaud Sterckx (IGRAC, NL)

#### Communities of Practice

MAR Communities of Practice are groups of individuals with an interest in sharing information at national level to improve the uptake, practice, governance and outcomes of MAR. To date four such groups have evolved: in China, Italy, Australia and Latin America. In

some countries IAH Chapters or other associations undertake these tasks, and IAH-MAR is happy to support those organisations with resources and experience gained elsewhere.

#### 2010 MAR Network China

https://recharge.iah.org/mar-network-china

#### 2015 MAR Network Italy

https://recharge.iah.org/mar-network-italy

#### 2017 MAR Community of Practice Australia

https://recharge.iah.org/mar-community-practice-australia

#### 2019 MAR Community of Practice in Latin America (LatinMAR)

https://recharge.iah.org/cop-latinmar

## MAR-related events involving IAH members

The year 2020 was a dramatic year marked by travel restrictions due to COVID-19 pandemic. Most international events had to be organised in virtual mode (online) with the events dedicated to MAR being no exception. Nevertheless, the co-chairs and members of IAH-MAR Commission co-organised and participated in a large number of online seminars and workshops. As expected, the new meetings format posed new challenges on MAR promotion worldwide and on the general activities of the Commission but offered also new, unexpected opportunities for collaboration. The list below includes a selection of MAR-related events involving IAH members and members of international MAR community.

"International Virtual Winter Seminar on Managed Aquifer Recharge" in Dresden, Germany

On 3 December 2020, Prof. Thomas Grischek and Dr. Cornelius Sandhu of the University of Applied Sciences (HTW) Dresden hosted an International Virtual Winter Seminar on Managed Aquifer Recharge briefly introducing MAR/RBF, applications, RBF hydraulics, RBF site selection and assessment, basin and abstraction well construction, and investigation sites in Dresden and Saxony. The seminar was organised in preparation of the upcoming International Summer School on MAR to be held between 22 August and 4 September 2021 in Dresden. More information about the seminar and the summer school are available at: <a href="https://www.htw-dresden.de/en/university/faculties/civil-engineering/studies/subject-areas/water-sciences/research/planned-research-topics">https://www.htw-dresden.de/en/university/faculties/civil-engineering/studies/subject-areas/water-sciences/research/planned-research-topics</a>.

The 3<sup>rd</sup> edition of the International MARSOLUT and LIFE REWAT Autumn School on "Digital water management and water-related agroecosystem services: geostatistics, hydroinformatics and groundwater flow numerical modelling

The 40-hours online course was organised by the Institute of Life Sciences of the Scuola Superiore Sant'Anna (Pisa – Italy) between 12 October and 23 November 2020 as part of the EU MSCA-ITN MARSOLUT project (https://www.marsolut-itn.eu/). MARSOLUT - Managed Aquifer Recharge Solutions Training Network - is a four-year Marie Skłodowska-Curie Actions (MSCA) Innovative Training Network (ITN) funded by the European Commission with participation of several long-term members of IAH-MAR Commission. MARSoluT intends to tackle specific technical challenges in the operation of Managed Aquifer Recharge (MAR) sites on a scientific basis. For more info about the project and the outcomes of the Autumn School visit the project website at: <a href="https://www.marsolut-itn.eu/">https://www.marsolut-itn.eu/</a>.

National Seminar on "Resilience of Groundwater Resources for Accommodating Changing Climate Scenarios"



On 7 November 2020, the Indian National Chapter of the Association of Hydrogeologists, association with the Department of Civil Engineering at Jamia Millia Islamia, Faculty of Engineering and Technology, organised a National Seminar on "Resilience of Groundwater Resources for Accommodating Changing Climate Scenarios". The seminar included four main themes, including MAR: T1: Emerging Techniques of Groundwater Exploration and Management. T2: Managed Aguifer Recharge, Groundwater Contamination and Treatment Techniques. T3: Groundwater Resources vulnerability, resilience and sustainable management. T4: Community Participation, Governance and Regulation for feasible mitigation. The Seminar Advisory Committee included Dr. Peter Dillon, co-founder of IAH-MAR Commission and former Co-Chair, and Prof. Antonio

Chambel, former IAH President. More information about the seminar is available on the IAH-MAR Commission website at the link: <a href="https://recharge.iah.org/files/2020/05/Final-Brochure">https://recharge.iah.org/files/2020/05/Final-Brochure</a> INCIAH National-Groundwater-Seminar Nov-07-2020 Version-3.0.pdf.

Presentation of Methodological Guide on MAR in Chile – online event entitled: "Soluciones hídricas para la Recarga de Acuíferos Gestionada en Chile"



The seminar took place online on 4 November 2020 and presented details of the recently elaborated guide for MAR in Chile, developed by CNR and CSIRO. The document entitled "Methodological Guide: Operational Framework for Artificial Aquifer Recharge Projects" was published in 2020 by the Ministry of Agriculture of Chile. The 38-page document describes the background of the regulatory framework regarding MAR in Chile and includes recommendations for selection of recharge components, method selection, as well as practical guidelines on project development and implementation. The Guide is supported by the National Aquifer Recharge Plan for Agriculture. More information about the guide and free download is the website: on

https://www.cnr.gob.cl/recarga-de-acuiferos/.

## The First IWRA Online Conference (IWRA2020): "Addressing Groundwater Resilience under Climate Change"

In 2020, the annual conference "Addressing Groundwater Resilience under Climate Change" organised by the International Water Resources Association (IWRA) went fully online between 29 and 30 October 2020. The conference was organised by IWRA in partnership with IAH and UNESCO IHP. More information about IWRA2020 https://iwraonlineconference.org. The conference included a session on managed aguifer recharge (session 2.8) entitled "Climate Change Effects on Groundwater Resilience (Pollution & Remediation)" as part of Theme 2 "Climate change effects on groundwater resilience (pollution and remediation)" with the following topics:

- Managed Aquifer Recharge as a source of emerging pollutant in groundwater
- Site suitability mapping for 'Managed Aquifer Recharge (MAR)' implementation in Poralai and Hangol, the coastal basins of Baluchistan, Pakistan
- Assessing the potential of artificial groundwater recharge: case study of Palla Road wellfields, Botswana
- Co-managing floods and droughts on the Gangetic Plain through a novel MAR approach
- The impact assessment of climate change on groundwater resource development in the Vietnamese Mekong Delta. Case study: Tra Vinh Province
- Water quality regulations and guidelines for Managed Aquifer Recharge –
   International synopsis, contrast and lessons learned
- Preliminary results of Rooftop Rainwater Harvesting and shallow well infiltration pilot project in the Danube-Tisza Interfluve, Hungary

Session on MAR at the 47<sup>th</sup> IAH Congress in Brazil: "Water for future generations: the urgent need to increase managed aquifer recharge"

Due to disruptions caused by COVID-19 pandemic, the 47th IAH Congress has been moved online. The conference adopted an innovative format, including a series of web-based seminars stretching for the duration of one entire year (Sep 2020 – Aug 2021). On 22 Oct 2020, a session on MAR entitled "Water for future generations: the urgent need to increase managed aquifer recharge" included speakers from Brazil, India, USA, and Spain.

The event was be streamed on the ABAS YouTube channel, registration and attendance was free of charge. For more info, visit the conference website at <a href="https://www.iah2021brazil.org">www.iah2021brazil.org</a>.



**ONLINE** | 09/21/2020 - 08/20/2021

**HYBRID** | AUGUST 22<sup>ND</sup> - 27<sup>TH</sup>, 2021 ESPAÇO ARCA - SÃO PAULO - BRAZIL









# WATER FOR FUTURE GENERATIONS: THE URGENT NEED TO INCREASE MANAGED AQUIFER RECHARGE 10/22/2020 | 11H30 (BRT) / 02:30 PM (GMT)



de Oliveira
HIDROPLAN | ABAS
The Groundwater Project



Prof. D. C. Singhal
President, IAH Indian
National Chapter
INDIA



Adam Hutchinson
Recharge Planning
Manager, Orange County
Water District
UNITED STATES
OF AMERICA



Fernández Escalante
Co-coordinator,
Commission on
Managed Aquifer
Recharge of the IAH
SPAIN



Bruna C. Soldera
President, IAH Early Career
Hydrogeologists' Network Brazil
BRAZIL

Free registration! Streaming by ABAS YouTube channel.

ORGANIZATION:











iah2021brazil.org

Online session on MAR at 47th IAH Congress in Brazil

- 1. IAH Indian National Chapter: Prof Singhal. "How India has become the country with more Monitored Aquifer Recharge (MAR) systems in the world".
- 2. Adam Hutchinson: "Increasing groundwater basin yield with managed aquifer recharge".
- 3. Enrique Fernández Escalante. "How MAR is facing up climate change adverse impacts".
- 4. Early Career IAH Brazil: Bruna Soldera. "Recharge and quality, compensation for water use".

In preparation of the conference, the organisers initiated specialised WhatsApp discussion groups on different thematic area. A group is dedicated to managed aquifer recharge, becoming a very interactive platform for exchange of information and experiences on MAR. By end of February 2021, the group includes 167 participants coming from different countries and backgrounds. The group can be joined at any time by scanning the QR code below:



Online seminar on "Artificial recharge – Integrating Science and Technology" as part of Indian National Ground Water Lectures

The National Chapter of the International Association of Hydrogeologists organised on 3 October 2020 a two-hour online seminar on MAR with the help of two panellists: Sh G. C. Pati, Chairman of Central Ground Water Board & Central Ground Water Authority, and Sh Avinash Mishra, Advisor on Water Land Resources, Environment & Forest, and NITI Aayong. The seminar was moderated by Prof D C Singhal, President of the Indian Chapter of IAH.

First online Latin-MAR seminar on "Managed aquifer recharge in Latin America: Experiences and challenges"

On 15 October 2020, the Latin American Community of Practice on MAR (LatinMAR) organised organise the first online seminar on "Managed aquifer recharge in Latin America: Experiences and challenges". The programme included presentations of MAR practices in Mexico, Chile and Argentina, as well as a virtual tour of the infiltration lagoons and wetland in San Luis Rio Colorado, Mexico. Language of the seminar was Spanish. The IAH-MAR Commission was represented by Enrique Fernández Escalante. Read more about the Latin American MAR Community of Practice and check the event programme here: <a href="https://recharge.iah.org/cop-latinmar">https://recharge.iah.org/cop-latinmar</a>.

The 17<sup>th</sup> Biennial Symposium on Managed Aquifer Recharge (BSMAR17): "Resilience through Recharge and Recovery"

Due to COVID-19 restrictions, also the 17<sup>th</sup> Biennial Symposium on MAR organised by the Arizona Hydrological Society (AHS) and the Groundwater Resources Association (GRA) of California had to go virtual (it was originally planned for April 2020). BISMAR17 was organised online between 5 and 9 October 2020 and included two pre-conference virtual workshops, a technical program, a plenary session and virtual social networking events.



New BSMAR17 flyer: "Resilience through Recharge and Recovery"

The workshops were provided by Michael Milczarek and Adam Hutchinson, who talked about State of the Art Techniques in Identifying and Characterizing Optimum Surface Spreading Groundwater Recharge Projects, and by David Pyne, speaking about Aquifer Storage and Recovery (ASR) wells. The Technical Program included 46 speakers plus a plenary session entitled "Managed Aquifer Recharge (MAR) and California's Sustainable Groundwater Management Act: Opportunities and Challenges". For this year, BSMAR 17 has teamed with the Floodplain Management Association to hold the Southwest Extreme Precipitation and Effects on Managed Aquifer Recharge (SWEPSYM). Up to date, the book of proceedings is not yet available but the proceedings of previous BSMAR conferences can be downloaded for free from: <a href="https://www.grac.org/bsmar/">https://www.grac.org/bsmar/</a>.

INTERREG online seminar on "Good Practices and Benchmark Analysis on MAR Solutions in the EU"

Held in the framework of the INTERREG project DEEPWATER-CE (<a href="https://www.interreg-central.eu/Content.Node/DEEPWATER-CE.html">https://www.interreg-central.eu/Content.Node/DEEPWATER-CE.html</a>), a series of online seminars are planned in English, Polish, Slovak, Hungarian and Croatian languages. The first event was organised by TU München on 23 September 2020 about developing an integrated implementation framework for Managed Aquifer Recharge solutions to facilitate the protection of Central European water resources endangered by climate change and user conflict. The report entitled "D.T1.2.1 Collection of good practices and benchmark analysis on MAR solutions in the EU" is available at: <a href="https://www.interreg-central.eu/Content.Node/DEEPWATER-CE/D.T1.2.1-Collection-of-good-practices-and-benchmark-analysis.pdf">https://www.interreg-central.eu/Content.Node/DEEPWATER-CE/D.T1.2.1-Collection-of-good-practices-and-benchmark-analysis.pdf</a> and the recording of the seminar is available on YouTube at <a href="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com/watch?v="https://www.youtube.com

Within the project, a second online seminar was dedicated to the development of a toolbox and its applications entitled "Transnational decision support TOOLBOX for designating potential MAR locations in Central Europe". The toolbox is available here: <a href="https://www.interreg-central.eu/Content.Node/2020-09-07-Handbook-Deliverable-D.T2.4.3-final.pdf">https://www.interreg-central.eu/Content.Node/2020-09-07-Handbook-Deliverable-D.T2.4.3-final.pdf</a> and the recording of the seminar is available on YouTube under the address: <a href="https://www.youtube.com/watch?v=OpaErm1GEGo">https://www.youtube.com/watch?v=OpaErm1GEGo</a>.

#### Capacity building on managed aquifer recharge in Africa

In order to meet the water availability challenges for increasing demand, the Regional Centre on Groundwater Resources Education Training and Research (RCGW) organised on 8 September 2020 a virtual training session on managed aquifer recharge for groundwater professionals from different Africa countries. RCGW was established in July 2010 in Nairobi, Kenia, as result of UNESCO-IHP Resolution XIX-6 which proposed the establishment of a Category 2 Center within the auspices of UNESCO. The aim of the Centre is very well aligned with the IAH-MAR Commission's objective: "to promote regional cooperation on the management of groundwater systems, train water professionals, support member states in addressing regional needs, and contribute to the achievement of Sustainable Development Goals (SDG2)". The keynote presentations were provided by two co-chairs of the IAH MAR Commission, Enrique Fernández Escalante and Catalin Stefan. Catalin introduced the activities of the Commission to the audience and discussed with the organisers the opportunities for future collaborations between the Commission and the RCGE Centre. Enrique gave a technical talk on various MAR mechanisms and current technical possibilities and discussed with the participants the prospects for boosting MAR implementation in African countries.









Online seminar on "Groundwater – Base Rock of Resilience" at World Water Week in Stockholm, Sweden

The Groundwater Solutions Initiative for Policy and Practice (GRIPP) coordinated by the International Water Management Institute (IWMI), in collaboration with the African Ministers' Council on Water (AMCOW), the German Federal Institute for Geosciences and Natural Resources (BGR), and the University of Victoria, hosted an online seminar series together with other co-convening partners at the World Water Week 2020. The aim of this series was to discuss the role of groundwater in a resilient development pathway under climate change and other slow- or fast-onset global disruptors. The webinar was targeted towards policy makers, practitioners, researchers, development partners and the private sector. The sessions included:

- Session I: AMCOW's Pan-Africa Groundwater Program A Roadmap to Resilience
- Session II: Global Groundwater Sustainability Statement Call to Action for Resilience
- Session III: Groundwater to the Rescue! Climate Adaptation from the Underground

Online seminar on "Experiences and proposals for improvement of the management of Ica's aquifers"



On 11 August 2020, the Co-Chair of IAH MAR Commission, Enrique Fernández Escalante contributed to an online seminar dedicated to groundwater management in Peru and Mexico. The seminar was organised by Comité Sur Ica (Peru) and included four slots about IWRM and MAR in Ica aquifer, steps advanced and future issues. The concerns about permissions from water authorities were smoothed after the most recent MAR activities. An

overview about MAR in Mexico was presented by Adriana Palma, the coordinator of Latin American MAR Community of Practice (Latin-MAR, https://recharge.iah.org/cop-latinmar).

Online seminar on facilitation of green adaptation techniques, including MAR, for reduction of water scarcity in Costa Rica



On 18 September 2020, the National University of Costa Rica (UNA) organised an online seminar on the topic of managed aquifer recharge (MAR) with focus on Costa Rica, Chile and other Latin American countries. The seminar was part of the collaboration project "Facilitation of green adaptation techniques for reduction of seasonal water scarcity in Costa Rica" between National University of Costa Rica Technische Universität Germany. On the German side, the project is led by Catalin Stefan, head of INOWAS research group and co-chair of IAH-MAR Commission, while in Costa Rica the project is under the coordination of Andrea Suarez

Serrano, General Coordinator of Centro de Recursos Hídricos para Centroamérica y Caribe (HIDROCEC-UNA). During the workshop (held in Spanish language), Enrique Fernandez (cochair IAH-MAR) provided an overview on most common MAR practices and techniques with practical examples from Spain and abroad. Other contributors included Roberto Ramírez, head of Investigación y Gestión Hídrica, SENARA (Costa Rica), José Bonilla, AyA (Costa Rica) and Carlos Flores, Dirección General de Agua del Ministerio de Obras Públicas (Chile).

Upcoming events related to MAR in 2021

- World Water Day Special Webinar Managing Aquifer Recharge: A Showcase for Resilience and Sustainability, 22 March 2021. Celebrate World Water Day on Monday afternoon, March 22, when the Water Resources Research Center hosts an informative panel discussion on the forthcoming UNESCO volume, "Managing Aquifer Recharge: A Showcase for Resilience and Sustainability." This UNESCO publication provides valuable resources for stakeholders and water managers considering managed aquifer recharge (MAR) as a mechanism to bolster climate resilience in the context of environmental, social, and economic project goals. The panel features two book editors along with authors of the volume's five North American case studies. More info at: <a href="https://wrrc.arizona.edu/world-water-day-special-webinar">https://wrrc.arizona.edu/world-water-day-special-webinar</a>.
- World Water Day China-Denmark MAR in China Webinar 22 March 2021. The Danish Embassy will host online water talks on the World Water Day, March 22nd 2021. The theme of World Water Day 2021 is Valuing Water. As Denmark relies on groundwater for 100% of its water supply, groundwater is valued dearly. This same view is shared in China. New research findings on Managed Aquifer Recharge (MAR) in China will be shared at this workshop to demonstrate its potential for climate proofing the challenged groundwater supply.
- International Symposium on Geofluids" (vGeofluids21), 7-9 July 2021, online event organised by József & Erzsébet Tóth Endowed Hydrogeology Chair, Department of Geology, Institute of Geography and Earth Sciences, Faculty of Science, Eötvös Loránd University, Hungary. The symposium includes one session on managed aquifer recharge. More info at: https://geofluids2020.hu/.
- 47<sup>th</sup> IAH Congress, 22-27 August 2021, Sao Paolo, Brazil. A series of bi-weekly online seminars including marketing, technical and scientific, inspirational, and professional training themes are organised between 21 September 2020 and 27 August 2021. In August 2021, the organisers planned the organisation of a hybrid event, in coordination with the organisers of the 48th congress in Brussels. More info at: <a href="https://iah2021brazil.org/en/">https://iah2021brazil.org/en/</a>.
- 48<sup>th</sup> IAH Congress "Inspiring Groundwater", Brussels, Belgium, 6-10 September
   2021. The IAH Belgian Chapter, together with its partners, is organising the 48th IAH Congress in the heart of Europe, Brussels. Abstract submission is open until 23 March 2021. For more information visit: https://iah2021belgium.org.
- International Summer School on Managed Aquifer Recharge, Dresden, Germany,
   22 August 4 September 2021. The two-week course offers M.Sc./Ph.D./young professionals the opportunity to study basic, advanced and applied aspects of Managed Aquifer Recharge (MAR) and Riverbank Filtration (RBF). The course consists of expert lectures, MAR computer modelling practice, laboratory experiments and technical excursions supplemented by participant presentations and informal discussion sessions. For more information check the school website.

## Publications on managed aquifer recharge

Special Issue in Water journal: "Managed Aquifer Recharge— Enhancing the Use of Alternative Water Sources for Subsurface Storage and Soil Aquifer Treatment"

A new special issue dedicated to MAR has been published in "Water", an open access journal of the MDPI publisher. The issue was organised by Dr. Daniel Kurtzman Institute of Soil, Water and Environmental Sciences, The Volcani Center, Agricultural Research Organization in Israel, and Prof. Dr. Christoph Schüth, Technical University Darmstadt, Institute for Applied Geosciences, Germany. The manuscript submission was closed on 31. October 2020, and by February 2021, 9 papers have been published online. The full version of the articles can be downloaded from the journal's website at: <a href="https://www.mdpi.com/journal/water/special">https://www.mdpi.com/journal/water/special</a> issues/Managed Aquifer Recharge.

Special Issue in Water journal dedicated to ISMAR10: "Managed Aquifer Recharge for Water Resilience"

The special issue included selected papers from the 10<sup>th</sup> International Symposium on Managed Aquifer Recharge (ISMAR10) organised between 20 and 24 May 2019 in Madrid, Spain. The Guest Editors of this issue were Dr. Peter Dillon (Australia), Dr. Enrique Fernández Escalante (Spain), Dr. Sharon B. Megdal (USA) and Dr. Gudrun Massmann (Germany). The volume was completed in 2020 and included 23 articles on different aspects of MAR. All full PDF versions of the articles can be downloaded for free from the MDPI Water journal website at the address: <a href="https://www.mdpi.com/journal/water/special issues/ISMAR10">https://www.mdpi.com/journal/water/special issues/ISMAR10</a> 2019. This electronic version will be followed in 2021 by the publication of a hardcopy version of the special issue.

Methodological Guide for Managed Aquifer Recharge in Chile published by the Ministry of Agriculture of Chile



The new guide was published in 2020 with the title: "Methodological Guide: Operational Framework for Artificial Aquifer Recharge Projects". The guide (in Spanish) is a product of the project "Operational Framework for Artificial Aquifer Recharge Projects" carried out by the National Irrigation Commission through CSIRO and provides a practical tool for the development of MAR projects in the agricultural sector. The final report of this project contains more detailed information on the development of this guide. Free download of the guide together with the National

Plan of Managed Aquifer Recharge for Agriculture: <a href="https://www.cnr.gob.cl/recarga-de-acuiferos/">https://www.cnr.gob.cl/recarga-de-acuiferos/</a>.

New USACE Report – Managed Aquifer Recharge (MAR) and the U.S. Army Corps of Engineers: Water Security through Resilience

The U.S. Army Corps of Engineers (USACE), Institute for Water Resources (IWR) released a new report about the use of managed aquifer recharge in a variety of settings and purposes, throughout the United States. The report covers a wide range of uses for MAR such as flood risk management, aquatic ecosystem restoration, drought resilience, salt-water intrusion prevention, and multi-purpose projects. The report is available for free download: <a href="https://www.iwrlibrary.us/#/document/16a468f6-1f43-46a4-b546-141594d30cde">https://www.iwrlibrary.us/#/document/16a468f6-1f43-46a4-b546-141594d30cde</a>.

#### UN-Water Analytical Brief on Unconventional Water Resources

This Analytical Brief on Unconventional Water Resources was prepared by UNU-INWEH on behalf of the UN-Water Task Force on Unconventional Water Resources. Excerpt extracted from the report description: "Reusing municipal wastewater and stormwater, potentially through managed aquifer recharge, and the use of residual water from agriculture are practiced in many regions. However, the implementation of such practices is on a small scale. These practices need to be more widely adopted. Recycling water is also energy-intensive, but will become more common with access to cheaper and decentralized energy. Still, these are usually less expensive options than bringing water from outside the catchment boundaries". The full PDF report can be downloaded for free at the following address: <a href="https://www.unwater.org/app/uploads/2020/08/UN-Water-Analytical-Brief-on-Unconventional-Water-Resources.pdf">https://www.unwater.org/app/uploads/2020/08/UN-Water-Analytical-Brief-on-Unconventional-Water-Resources.pdf</a>.

### ASCE Standard Guidelines for Managed Aquifer Recharge

"Standard Guidelines for Managed Aquifer Recharge, ASCE/EWRI 69-19", provides a thorough and up-to-date description of Managed Aquifer Recharge (MAR) projects. The standard includes details on planning, design, construction, operation, monitoring, and closure of MAR projects, along with background information on groundwater and MAR concepts. It also describes the economic, environmental, and legal considerations, such as water rights, laws, and regulations, as well as field investigation and testing procedures that may apply. The content of this standard has been designed to meet the needs of water resources planners and stakeholders during the initial evaluation and planning phases, along with the needs of engineers, hydrologists, and other professionals for standardization of MAR practices from conceptualization to operation. More info and options for e-book download or for buying the print book at: <a href="https://doi.org/10.1061/9780784415283">https://doi.org/10.1061/9780784415283</a>.

New research report from International Water Management Institute (IWMI) on "Underground Transfer of Floods for Irrigation (UTFI): Exploring the Potential at the Global Scale"



UTFI structures in India (photo: Prashanth Vishwanathan / IWMI)

Underground Transfer of Floods for Irrigation (UTFI) is a term used for capturing and storing high surface water flows in the underground. The UTFI structures can be widely distributed and integrated in landscapes that are prone to flooding, bringing multiple social and environmental benefits. In their newest report, IWMI assessed the global potential for UTFI using datasets on flood and drought frequency, economic losses and mortality along with available groundwater storage. The results indicated that about 11% of total world area has high potential for UTFI implementation, a very promising outcome for this technique related to managed aquifer recharge. For more information check the IWMI blog here: <a href="https://www.iwmi.cgiar.org/2020/09/tapping-into-the-ground-to-counter-floods-and-droughts/">https://www.iwmi.cgiar.org/2020/09/tapping-into-the-ground-to-counter-floods-and-droughts/</a> and download the report here: <a href="https://www.iwmi.cgiar.org/publications/iwmi-research-reports/iwmi-research-report-176/">https://www.iwmi.cgiar.org/publications/iwmi-research-report-176/</a>.

Online inventory of proceedings and abstracts books of all ten ISMAR symposia

The International Symposium on Managed Aquifer Recharge (ISMAR) is the premier international event on MAR research and practice, held every 3 or 4 years under the auspices of the International Association of Hydrogeologists (IAH), the American Society of Civil Engineers (ASCE), and the United Nations Educational, Scientific and Cultural Organization (UNESCO). This series of conferences advances the goals of IAH's Commission on MAR "to expand water resources and improve water quality in ways that are appropriate, environmentally sustainable, technically viable, economical and socially desirable".

To enhance the access to information and promote the worldwide dissemination of knowledge on MAR, the Co-Chairs of IAH-MAR Commission compiled an overview on all past ten ISMAR symposia, from ISAR1 in the USA in 1988 to ISMAR10 in Spain in 2019. The collection is meant to serve as an online repository for conference materials such as books

of proceedings, abstracts etc. A dedicated page was created (https://recharge.iah.org/ismar) on the IAH-MAR website which includes readily accessible conference materials (due to copyright-related reasons, not all proceedings are available for direct download from the IAH-MAR website; in these cases, a link is available to purchase the book online).



Collection of conference materials such as books of abstracts, proceedings, conference agenda, etc. from all ten ISMAR symposia starting from 1988 until 2019

We warmly recommend also the collection of Proceedings of the Biennial Symposium on Managed Aquifer Recharge (BSMAR) organised in the US by the Groundwater Resources Association of California and Arizona Hydrological Society: <a href="https://www.grac.org/bsmar/">https://www.grac.org/bsmar/</a>.

## Invitation

Members of IAH and others are invited to participate in this Commission to receive and contribute news and information via our email list, to attend symposia and workshops, notably ISMAR11 in April 2022 in Long Beach, California, USA, and to join and initiate formation of working groups that produce needed specific outcomes over a finite time frame. You can join our email list from the Commission website <a href="https://recharge.iah.org/">https://recharge.iah.org/</a>. If you find this Commission useful, you are likely to find joining IAH as a member is also useful <a href="https://iah.org/join-us">https://iah.org/join-us</a> — through access to Hydrogeology Journal, newsletters and a wide range of Commissions and Networks, and discounted registrations to IAH Congresses and ISMARs.

Enrique Fernández Escalante, Catalin Stefan and Yan Zheng Co-Chairs of IAH Commission on Managing Aquifer Recharge https://recharge.iah.org/

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