Hind regeologists

IAH Commission on **Managing Aquifer Recharge** 'Plenary Session'



10 September 2018

45th IAH Congress, Daejeon, Korea

FIND OUT WHAT IAH-MAR DOES. JOIN A WORKING GROUP. LEAD A NEW ACTIVITY. GET INVOLVED, MAKE A DIFFERENCE..

Co-chairs: Peter Dillon, Weiping Wang and Enrique Fernández-Escalante

Web sites: English: https://recharge.iah.org/ Spanish: www.dina-mar.es/ Chinese: http://china-mar.ujn.edu.cn/

Commission on Managing Aquifer Recharge:

2. Objectives www.iah.org/recharge

To promote the securing and expanding of water resources and improving water quality in ways that are appropriate, environmentally sustainable, technically viable, economic and socially desirable.

To encourage research, development and adoption of improved practices for management of aquifer recharge

To improve knowledge, skills and capabilities of practitioners, water resources managers and regulators.

To facilitate 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.

It aligns with Strategic Plan of UNESCO IHP-VIII (2014-2021) "WATER SECURITY: RESPONSES TO LOCAL, REGIONAL, AND GLOBAL CHALLENGES" Specifically: Focal Area 2.2 - Addressing strategies for management of aquifers recharge

IAH-MAR Plenary Agenda



2. Objectives of Commission / UNESCO IHP VIII 2014-2021 context for IAH-MAR role

3. Plans of current working groups



- 1. MAR for Sustainable Development Yan Zheng (SUST, PR China)
- 2. Global MAR Inventory Catalin Stefan (TU Dresden- Germany) with Nienke Ansems / Arnaud Sterckx (IGRAC, NL) 3. Economics of MAR - Andrew Ross (ANU, Australia)
- 4. 60 years history of MAR Peter Dillon (CSIRO, NCGRT, WGA Aust) and Pieter Stuyfzand (KWR & TU Delft, NL) 5. Monograph on clogging and its management - Russell Martin (WGA Pty Ltd, Australia)
- 6. MAR to MARket Enrique Fernández Escalante (Tragsa, Spain)
- 7. MAR water quality guidance and regulations Manuel Sapiano (Malta Energy and Water Agency) 8. MAR opportunity mapping (proposal) - Catalin Stefan/ Jose Bonilla
- Outcomes of ISMAR9
- 5. ISMAR10 Invitation Madrid Enrique Fernandez Escalante / Antionio de la Orden
- 6. Process for bidding to hold ISMAR11.
- 7. Next election of IAH-MAR Co-chairs is at ISMAR10
- 8. Information Sharing (4 x 3 +1 = 13min)
- 1. GRIPP Groundwater Solutions Initiative for Policy & Practice Karen Villholth/Andrew Ross/Catalin Stefan 2. MAR-NET activities in China - / Germany / Denmark - Yan Zheng
- 3. MARVI project village interventions India- Peter Dillon
- 9. Suggestions for new activities anyone
- Volunteers to participate in existing and new activities anyone
- 11. Information sharing on MAR (not covered elsewhere) anyone
- 12. Sessions 4.4 tomorrow Peter
- 13. Close of Plenary (Next Plenary at ISMAR10, Madrid, May 2019)

IHP VIII 2014-2021 Context for MAR and role of IAH Commission

Peter Dillon/ Aurélien Dumont on behalf of Alice Aureli, UNESCO IHP. Paris



Groundwater in IHP VIII (2014-2021) : http://www.unesco.org/new/en/naturalsciences/environment/water/ihp-viii-water-security/

Theme #2. Groundwater in a changing environment

Focus areas:

2.1 Enhancing sustainable groundwater resources management
2.2 Addressing strategies for management of aquifer recharge
2.3 Adapting to the impacts of climate change on aquifer systems
2.4 Promoting groundwater quality protection
2.5 Promoting management of transboundary aquifers

Note: actions to address themes are interconnected

3. Working Groups

1. MAR for Sustainable Development – Yan Zheng (SUST, PR China)

2. **Global MAR Inventory – Catalin Stefan** (TU Dresden- Germany) with Nienke Ansems / Arnaud Sterckx (IGRAC, NL)

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Focus Area #2.2 Strategies for MAR

General objective:

Improve security and quality of water supplies especially in water scarce areas under climate change and population growth

Specific Objectives:

- Integrate managed aquifer recharge into IWRM to address effects of locally changing climate (WG4), population and food production (WG2, WG3, & joint proposal IAH-UNESCO -> GRIPP)...
- 2. Develop and apply methods to assess impacts of recharge structures on water availability and quality, social and economic resilience and local ecosystems (WG2,WG3, WG6, ISMAR9 (SWARM J and J Water thematic issues)
- 3. Evaluate the and benefits of recycling of appropriately treated urban waste and storm water for aquifer recharge (WG5, ISMAR9 (J Water thematic issue)...
- 4. Enhance governance capacities and institutional and legal frameworks to aid effective MAR implementation. (WG2, MAR GLS India .. billon P, Vanderzalm, J, Sidhu, J, Page, D., Chadha, D. (2014). A Water Quality Guide to Managed Aquifer Recharge in India. CSIRO Land and Water and UNESCO Report of AusAID PSLP Project ROU 14476. https://publications.csiro.au/rpr/pub?pid=csiro:EP149116 ..+WG3 China) do more?
- 5. Develop a scientific basis for the prevention and management of clogging (WG1)

3.1. MAR for Sustainable Development – Yan Zheng (SUST, PR China)

- Also a recent request from UNESCO to produce an a set of example projects for a UNESCO publication by Nov 2019. – we suggest selections aim to account for demonstration of sustainability...
- We will need people with access to MAR site information to volunteer to write a case study when criteria and format have been set... (would be co-authors of UNESCO report)

MAR for Sustainable Development Working Group Report @45th IAH Congress, Sept 10-14, 2018

Collective Role @ ISMAR9, 2016

- Help individual hydrogeologists to raise awareness
- Dissemination tool-kit:

Define metrics for successful MAR projects Identify successful MAR projects Develop factsheets of successful MAR projects

• Survey during ISMAR9 to clarify the role of this Working Group

Contact: yan.zheng@sustc.edu.cn

3.2. Global MAR Inventory – Catalin Stefan (TU Dresden- Germany) with Nienke Ansems / Arnaud Sterckx (IGRAC, NL)

IGRAC MAR Portal:

Stefan, C and Ansems, N. (2018). Web-based global inventory of managed aquifer recharge applications. Sustain. Water Resour. Manag. Vol 4 (2) p153-162. <u>https://doi.org/10.1007/s40899-017-0212-6</u> (open access)

(SUPER PAPER! >700 reads in 1st two months – This is a paper of the IAH-MAR Working Group on Global MAR inventory involving TU Dresden and IGRAC)

Bonilla Valverde, J.P., Stefan, C., Palma Nava, A., da Silva, E.B. and Pivaral Vivar, H.L. (2018). Inventory of managed aquifer recharge schemes in Latin America and the Caribbean. Sustain. Water Resour. Manag. Vol 4 (2) 163-178 https://doi.org/10.1007/s40899-018-0231-y

Both papers available from: <u>https://recharge.iah.org/swarm-vol-4-issue-2-june-2018</u>











Australian National University

Report of IAH MAR Working group on Economics of Managed Aquifer Recharge

Dr Andrew Ross

Fenner School of Environment and Society, Australian National University

Email <u>a.ross@anu.edu.au</u> Phone 61 2 6125 8132

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Australian National University

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Program of IAH MAR Economics Working Group

- Working Group program is being developed in two stages:
 - Stage 1: 2016-18: Collection & analysis of financial (cost) data for selected MAR schemes
 - Ross, A and Hasnain, S (2018) Factors affecting the cost of managed aquifer recharge schemes, Sustainable Water Resources Management 4:179-190
 - Further paper in preparation including larger number of schemes
 - Stage 2: 2018 onwards: Cost effectiveness and cost benefit analysis of selected MAR schemes
 - Further paper(s) planned including cost effectiveness of selective schemes compared with alternative supply options and economic viability of selected in MAR schemes

3.4 60 years history of MAR – Peter Dillon (Australia) and Pieter Stuyfzand (NL)

Published 7 Sept 2018 in Hydrogeology Journal

Dillon, P., Stuyfzand, P., Grischek, T., Lluria, M., Pyne, R.D.G., Jain, R.C., Bear, J., Schwarz, J., Wang, W., Fernandez, E., Stefan, C., Pettenati, M., van der Gun, J., Sprenger, C., Massmann, G., Scanlon, B.R., Xanke, J., Jokela, P., Zheng, Y., Rossetto, R., Shamrukh, M., Pavelic, P., Murray, E., Ross, A., Bonilla Valverde, J.P., Palma Nava, A., Ansems, N., Posavec, K., Ha, K., Martin, R. and Sapiano, M. (2018). Sixty Years of Global Progress in Managed Aquifer Recharge. Hydrogeology Journal https://doi.org/10.1007/510040-018-1841-z .

At <u>https://rdcu.be/530U</u> you can download the paper, national summaries for 16 countries, and pictures and descriptions of MAR examples. All free thanks to UNESCO covering open access charge. Also a talk tomorrow. 3.5. Monograph on clogging and its management – Russell Martin (WGA Pty Ltd, Australia)

Monograph on clogging and its management – Russell Martin (Aqueon Pty Ltd / WGA) 2013

Much material is loaded on IAH-MAR web site More is needed documenting the management of clogging

www.iah.org/recharge/clogging.htm

Russell is calling for more contributions for a second edition focused on management of clogging

To: Russell Martin <rmartin@wga.com.au>



3.6. MAR to MARket – Enrique Fernández Escalante (Tragsa, Spain)

Working Group 1 - Clogging

- Aim to have Volume 2 ready for ISMAR10 – Madrid May 2017
- Option 1 New material seeking papers on
 - Low cost low tech applications to reduce/manage clogging
 - MAR clogging indicators
 - Case studies on clogging during MAR
- Option 2 Synthesis of clogging presentations from previous ISMAR proceedings.



3.7. MAR water quality guidance and regulations – Manuel Sapiano (Malta Energy and Water Agency)

- Manuel had made a contribution to the governance part of the 60 year history of MAR paper
- He is preparing a paper for ISMAR10 to list and compare existing state and national water quality guidelines and regulations for MAR. He invited anyone who was aware of such a guideline in their country to send him the web link or a copy to add to those on the web site: https://recharge.iah.org/mar-regulations

3.8. MAR opportunity mapping (proposal) -Catalin Stefan/ Jose Bonilla

MAYA)

(jpbonilla@aya.go.cr) Arnaud Sterckx

Daniel J Goode

Background

MAR suitability map for Costa Rica

Source: Bonilla et al., 2016. Water, 8(9), 391 https://doi.org/10.3390/w8090391

· inconsistent methodology for GIS-based selection of suitable sites for MAR • different purpose, criteria, MAR method, scale, etc.

IAH MAR Plenary Session | Daejeon, September 10th, 2018

MAR suitability map for Spain

Source: DinaMAR, 2010 http://www.dina-mar.es/





WHAT	ном
Review available studies on GIS-based selection of sites suitable for MAR application and publish the results in an open access paper.	Sallwey et al. 2018. Suitability maps for managed aquifer recharge: a review of multi-criteria decision analysis studies. Environmental Reviews, <i>accepted</i>
Initiate a network of scientists and stakeholders to share experiences on MAR suitability maps (criteria, scales, objectives, applications etc.)	Regular meetings during IAH and ISMAR symposia i.e. Workshop during ISMAR10 Symposium in Madrid, Spain, May 2019 (registration under: https://www.ismar10.net)
Establish common GIS-based suitability mapping language and methodologies	Proposal for IAH Guideline

IAH MAR Plenary Session | Daejeon, September 10th, 2018

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4. ISMAR9 Mexico City June 2016 - outputs

2 special issues of journals each with 18 papers- all papers downloadable at no cost from https://recharge.iah.org/thematic-issues-iournals and links within:

- Water quality considerations for MAR systems MDPI J Water 2017 eds: Pieter Stuyfzand and Niels Hartog.
- MAR in Integrated Water Resources Management Springer J of Sustainable Water Resources Management, Vol 4 (2) eds: Peter Dillon, Paul Pavelic, Weiping Wang and Adriana Palma Nava. Journal format from https://link.springer.com/journal/40899/onlineFirst/page/1 and with Springer's permission, in author-format as open access from IAH web site
- Poster papers on IAH-MAR Spanish website www.dina-mar.es/
- 'A Call to Action for Groundwater Management' based on workshops at ISMAR9, from Wkg Gp led by Tim Parker, & communicated through IAH-MAR and GRIPP. https://recharge.iah.org/call-to-action-ongroundwater-management

5.

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Abstract submissions

• go to http://www.ismar10.net/ get abstract template, write abstract, submit using the submission platform:

https://www.ismar10.net/en/submission-platform/

by 1 November.

- Abstracts selected for presentation or poster will be asked to write a very brief paper (3p) to go in the conference proceedings
- Based on presentations and papers, 18 papers will be selected at the Symposium for extension (~12p) and open access publication in J Water (citation index 2.1) without author charges for a special issue in J Water. (CI >2). Others may submit with reduced author charges for same issue.

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7. Next election of IAH-MAR Co-chairs is at ISMAR10

- 2 of the 3 co-chairs are stepping down at ISMAR10 (Weiping and Peter)
- We need volunteers to nominate for these positions, prior to elections at ISMAR10
- If you are interested suggest you discuss with Peter to find out what is involved and decide whether to stand.
- Wonderful non-monetary remuneration you can make a difference!

6. Process for bidding for ISMAR11

- IAH, UNESCO and ASCE seek an interested consortium to run ISMAR11 in 2022
- Need committed people
- Interesting MAR projects that could be seen on a technical /sightseeing tour
- Ability to assemble a bid by January 2018
- Decision to be announced at ISMAR10, May 2019
- Contact Peter in first place for more information

8. Information Sharing

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GRIPP Initiative on Groundwater based natural infrastructure (GNBI)

GNBI defined as human approaches or interventions that intentionally utilize and manage groundwater and subsurface systems and processes in order to increase water storage, retention, water quality and environmental functions or services for the overall benefit of water security and human and environmental sustainability and resilience

GNBI cases				
Framework/introduction	Framework/introduction	General/global		
Water storage	MAR in rice fields with payment for ecosystem services MAR with desalinated water in LIWA Desert MAR through Village Level Intervention (MARVI) MAR for multiple purposes in Nebraska Sand dams in Kenya	Japan Abu Dhabi India Nebraska Kitui, Kenya		
Water retention	Water for Roads Underground Taming of Floods for Irrigation (UTFI)	Kenya and other India		
Water quality	MAR in coastal areas River Bank Filtration (RBF) for drinking water Urban stormwater recharge to freshen brackish aquifers Low-cost aquifer storage and recovery in coastal areas Accidental MAR	Netherlands India Adelaide, Australi Bangladesh India		
Environmental support	MAR for biodiversity (birds) Bore capping and environmental remediation	California Australia		
Tools	Global MAR Portal/MAR modelling tool	Global		













MAR-NET China Report

- Sino-German MAR Consortium Objective:
- a. facilitate continuous Sino-German cooperation.
- b. develop and deploy commonly accepted state-of-theart MAR approaches for reliable and cost-effective applications.
- c. promotes knowledge sharing of successful MAR projects in operation in Germany and China.
- d. initiates common research and application projects, promotes and enables Ph.D. student and post-doctoral trainee exchanges.

MARVI - MAR and Village level interventions for sustaining livelihoods - Rajasthan and Gujarat

MARVI was one of the topic areas presented last week at the World Water Forum 2018 in Stockholm, Sweden (please see the email below). You can see the MARVI case study at the following link:

http://gripp.iwmi.org/natural-infrastructure/water-storage/

MyWell version 2.0 is under development: - a mobile phone ap for crowd sourcing rainfall,groundwater level and check dam water level measurements. Allows eg calculation of infiltration rates.

BJ training completed and village groundwater cooperatives have been formed and regarded as a model for participatory gw management

See https://recharge.iah.org/marvi

MAR-NET China Report Sino-German MAR Consortium Members: Beijing Water Science and Technology Institute (BWSTI) 1. Chinese Institute of Water Resources and Hydropower Research (IWHR) 2. China Institute of Geo-environment Monitoring (CIGEM) of China Geological 3. Chir Survey (CGS) CONSULAQUA Hamburg - Consulting and engineering services in water resource management Institute of Hydrogeology and Environmental Geology (IHEG) of China 5. Geological Survey (CGS) Jinan University, School of Environment and Resources 6. Research Institute for Water and Waste Management at RWTH Aachen, FiW 7. 8. Ribeka GmbH - Software solutions for ground water management SEBA Hydrometrie GmbH & Co. KG - Producer of groundwater measurement technique Southern University of Science and Technology (SUSTech), School of 10 Environmental Science and Engineering TU Darmstadt, Institute of Applied Geosciences 11

9. Information sharing on MAR (not covered elsewhere) - anyone

- Maike Groeschke with BGR starting investigations for a MAR pilot project in Chad seeking guidance, and will aim to use ISMAR10 for communicating and capacity building
- Boris Matti six MAR techniques are to be piloted in Kabul, Afghanistan will aim for papers in ISMAR10 and bringing local staff
- Agnes Tahy spoke of gross expansion of irrigation in Hungary and potential depletion would like to map where MAR is possible, and link up with new WG. Also a Water Summit in Hungary next year gives a possibility to highlight riverbank filtration, what contributes 90% of water supply.
- Simon Higginson (Australia) mentioned the Perth Groundwater Replenishment Scheme (4 papers tomorrow) with extensive deep drilling underway now – Andrew asked if cost information could be provided
- Tao Cui (Australia) asked whether anyone else had used modelling to plan locations of MAR sites – and Catalin Stefan responded saying they have added optimization to this and Ralph would be talking on this.
- Yongcheol Kim (Kigam) reported that there were many examples of MAR in Korea, that he had pioneered the Jeju- friendly MAR there, Prof Ha was giving a summary talk of six types of MAR, also including the oldest riverbank filtration site which is a feature of tour no 5 on Wednesday.

10. Suggestions for new activities – anyone

- There was considerable interest in the new working group focusing on methodology for mapping MAR opportunities
- Commission needs to advise this is happening to give voice to those who wish to contribute to scoping a workshop at ISMAR10, that will then determine next steps

12. Sessions 4.4 MAR

- Rm 107: 11:30am 12:30pm Mon 10th (4)
- Rm 106: 11:15am 12:30pm Tues 11th (3)
- Rm 107: 4.00pm 5.45pm Tues 11th (7)
- Rm 101: 11:15am- 12:30pm Fri 14th (2)
- Plus MAR papers in other sessions (8)
 - Total (25)
- Plus 2 poster papers on MAR, and a number of papers closely related to MAR (eg ATES and injection induced seismicity keynote address). This is a likely a record for MAR papers in an IAH Congress.

11. Volunteers to participate in activities – anyone

All working groups are looking to assimilate information globally on well-defined topics to help answer questions and improve MAR design and operation. If you have information that you think could be useful to any working group, please send it to the WG leader. Emails are listed on the website :

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





Remember: Abstract submissions

http://www.ismar10.net/

Send your abstract by means of the submission platform: <u>https://www.ismar10.net/en/submission-platform/</u>