

Proposal for an IAH-MAR Working Group on International Inventory of MAR

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Christoph Sprenger (DEMEAU) ..

Others who wish to contribute

Historical Background and Motivation for this Working Group

Long before the IAH MAR Commission existed, one of its founders, Ivan Johnston (USGS), in the 1970s and 1980s had drafted a type-written questionnaire on MAR sites, that he circulated with the aim of publishing a consolidation of the data. People then, as now, were loathe to fill in forms and the information he received on sites, largely in the USA, was sparse. On the formation of the Commission in 2001 it was recognised that there was value in documenting the accomplishments of MAR in achieving water supplies for drinking and irrigation. Albert Tuinhof (Acacia, NL), issued a questionnaire to attendees of ISAR4 in Adelaide in 2002, and subsequently national summaries of this site specific information were made available via an IGRAC portal, with a world map coloured in various shades of green, on which a click would reveal the number of sites in each country. Albert went on to edit an anthology of examples of MAR using contrasting methods at about a dozen sites in arid and semiarid areas. However the web site has not been updated, and does not contain information of much value to potential new proponents of MAR. Recently Christoph Sprenger of the DEMEAU EC project developed an inventory of 280 European MAR sites, and had discussed with IGRAC the possibility of this going onto the IGRAC site and being widened. However the DEMEAU project had a finite life and a change in personnel at IGRAC had impeded progress. Concurrently Catalin Stefan assigned some students to this task and made use of the publically available format of the DEMEAU project, to enter about 1200 sites into a data base which brings us to the present.

The motivation for developing this information is unchanged. Although many more hydrogeologists are aware of MAR, the majority of organisations involved in decision making on new water supplies are not. Aquifers are often overlooked, and even if there is a vague awareness of MAR, it has been seen as an emerging technology, innovative, but risky and not something that can be relied on to meet shortfalls in water supply. Often very much more costly, but considered safe solutions, are adopted because of lack of awareness and confidence of the effectiveness of MAR under comparable circumstances. Hence it is unlikely to be effective just to state the increasing number of MAR sites, we need to be able to show the relevance of those sites to characteristics of new sites under consideration for water supply expansion, water security increase or water quality improvement. It will also be important to reveal the range of the nature of aquifers in the area under consideration, to identify whether suitable storage targets occur.

Target audiences for this information would include:

- Development banks
- National, provincial and local governments
- Water utilities
- Agricultural bureaux
- Hydrogeologists

Types of information that could be generated:

- Maps of MAR sites, all categories and also by aquifer type, source water type, end use or purpose, climate, MAR method (or class of methods), scale of project
- Unit costs of water supply

- Capital costs of water supply capacity expansion
- Water quality improvement
- Integration into water supply
- Existence of regulatory framework (a) for water entitlements, and (b) for health and environmental protection.
- Failures causing MAR to be discontinued

Table 1: Audience interests in Working Group products (Catalin, I don't think this gives good differentiation, but you or IGRAC may have different ideas that may make retaining some type of table worthwhile.

Audience	Mapping products for base data	Spreadsheet or data base for base data	Journal Papers or Reports	Cost information *	Water quality information *
Development banks	1		1	1	
National, provincial and local governments	1	1	1	1	1
Water utilities	1	1	1	1	1
Agricultural bureaux	1	1	1	1	
Hydrogeologists	1	1	1	1	1

* The bulk of sites may have only the basic data, but a smaller number may have cost information and/or water quality data.

Cost information would be converted to levelised cost at say 2014 in the currency of the country using the ave discount rate from date of construction to 2014 applicable in that country. It would also be possible to translate to US\$ 2014, but would need to check the method with world bank. (To do so is likely only to interest international development banks.)

Water quality is data hungry, and site specific, so frankly I think it could involve a large investment of time for information that would be difficult to apply. Water quality varies with time. I would want to consult Thomas Grischek, and have a water quality specialist lead that work if it was deemed worth proceeding with. Perhaps the water quality section could be abbreviated to a list of the pre and post treatments given to water before recharge and after recovery, for the basic data sheet.

In the first instance, a tag should be given to each site in your current data base if it has water quality data published/available and a tag for each site for which cost information is available.

Finally there are existing web based inventories and other relevant materials that can also be referenced, such as:

- Selected international case studies in Tuinhof and Heederik (2002) http://siteresources.worldbank.org/INTWRD/Resources/GWMATE_Final_booklet.pdf
- IGRAC- 2005 inventory is being replaced www.un-igrac.org

- UNESCO (2014) Menarid Workshop Amman, Dec 2012
<http://unesdoc.unesco.org/images/0022/002281/228109e.pdf>
- Catalogue and case studies of Natural Water Retention Measures in Europe (www.nwrm.eu)
- DEMEAU Project – developed for Europe (technologies for treatment) – 220 sites included
<http://demeau-fp7.eu/demeau-sites>
- Water Sensitive Urban Design – local inventories eg <http://watersensitivesa.com/news/new-website-coming> .

Objectives of Inventory Working Group in relation to IHP 8:

As with other IAH-MAR working groups this working group will contribute to **IHP 8** Theme 2 *Groundwater in a changing environment*, and particularly focus area 2.2 *Addressing strategies for management of aquifer recharge*, that has the general objective to Improve security and quality of water supplies especially in water scarce areas under climate change and population growth. In particular the Inventory Working Group will specifically assist in acceptance of MAR as a valuable element of IWRM that will facilitate its adoption to address effects of locally changing climate, population and food production.

Outputs required to achieve objectives:

1. A public web accessible GIS display of the status of MAR internationally including ;
 - a. Maps of all MAR sites and possible screening of these based on water type, aquifer type, type of recharge method, purpose of MAR and end use of effluent (irrig, drinking, env, industrial), global or countries or geographic regions, and whether cost info exists.
 - b. This could also have overlays with respect to climate, state of water stress, climate change projections, population growth projections, water use projections and geographic relief.
 - c. This could also have overlays in relation to presence of water allocation plans, and water quality protection for human health and the environment.
 - d. The relationship between volume of MAR, volume of groundwater use and volume of groundwater overdraft at national level, and total water use or percentage of total water use derived from groundwater resources
2. A data base that includes information on costs for sites where that information is available.
3. A data base that includes information on pre-and post treatment methods in use and a list of water quality issues that were addressed at each site, for sites where this information is available.
4. A data base that includes a summary of what monitoring is carried out at MAR sites (eg number of monitoring wells, frequency of water quality measurements, presence of automated systems) for which this information has been published.
5. At snapshots in time, which may be three-yearly, (linked to updating of the data base focussed on ISMAR symposia), to synthesise the data into status reports, where possible with diagnostics. The first of these may be published in an open access journal and expanded to a UNESCO report that can subsequently be downloaded from the IGRAC web site. This could also be presented as a paper to ISMAR9 and with more detail on relevant sections in the MAR and development workshop at ISMAR9.
6. If possible to include cost information in the above report(s) to do so and release this targeted for international development banks, citing benefit-cost ratios for documented MAR projects and give comparisons with traditional alternatives.

7. To present one or more papers on MAR participate a report or paper on levelised costs (for water supply or water treatment) or capital costs per supply capacity (for water security) if possible by ISMAR9, otherwise afterwards from information secured from delegates
8. To present one or more papers on water quality treatment methods and also monitoring employed at MAR sites, with a view to start tracking changes over the longer term.
9. To report on progress of the working group at ISMAR9 (after the IAH-MAR plenary) to determine whether the objectives have been met whether there should be changed objectives, and to determine who would participate in the group over the 3 years to ISMAR10.

Activities

1. The working group leader will agree on the scope of activities and time frame with the Co-Chairs and IGRAC
2. A data base form and means of uploading data will be agreed between these parties before circulation of an invitation to all on the IAH-MAR email list to contribute such data using fields already in use, rationalised where possible to encourage use and to augment with key missing information.
3. The working group will seek to widen the number of contributions, validate contributions with nationals (perhaps working with national chapters of IAH where needed) and follow up on missing information that is judged to be of high value and likely to be present. IAH-MAR cochairs are willing to help promotion when all is in agreement.
4. The working group will maintain a publications data base referenced to the sites, and of contacts of information sources to facilitate future updating of information.
5. Of importance, it will be valuable for the working group to ascertain which sites are discontinued and reasons why and be able to report those in summary form with diagnostics in future.

Resources

At this stage resources available are:

- Willing volunteer to lead the group
- Willing and capable researcher from IGRAC, approved by the Director, to help with the design and of the IGRAC MAR portal that is capable of displaying information in useful ways as agreed with the working group, giving access to the spreadsheet/data base of sites to encourage future research, and a procedure for uploading information from multiple sources with quality control
- Willing students to assist the working group leader
- Willing contributors from the Commission in all countries in which it is represented
- UNESCO has agreed in principle to support a UNESCO publication in this domain, written by the working group.
- Assistance from the IAH-MAR co-chairs in helping with directions to maximise the value of effort exerted in this domain.

Catalin Stefan, Nienke Ansems & Peter Dillon 22/9/15 (All who are named to edit in track changes, so that we have something we agree to, that can then be put to Nino Kukuric and Alice Aureli.