

MANAGED AQUIFER RECHARGE

IGRAC, YOUR PARTNER IN MAR

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Managed Aquifer Recharge (MAR) is a promising adaptation measure to reduce vulnerability to climate change and hydrological variability. MAR can play an important role as a measure to control over-abstraction and to restore the groundwater balance. MAR can be used to recharge aquifers subject to declining yields, to control saltwater intrusion or to prevent land subsidence. MAR may also be applied to sustain or improve the functioning of ecosystems and the quality of groundwater.

A main advantage of MAR technology is its flexibility and applicability to different scales and purposes. MAR is however not a remedy for water scarcity in all areas. Aquifer conditions must be suitable and (excess) source water must be present. The potential of MAR applications should be preliminarily assessed before field activities initiate.

ONLINE MAR PORTAL

The MAR Portal contains detailed information on MAR sites around the world as well as regional MAR suitability maps. By facilitating access and promoting international sharing of information and knowledge on MAR, the MAR portal encourages stakeholders to consider MAR as a viable solution for sustainable groundwater resources development and management.

GLOBAL INVENTORY OF MAR SCHEMES

Many existing schemes offer excellent best-practice examples which can be useful during the planning and the implementation of new projects. About 1200 case studies from over 50 countries were compiled and analysed in the first global inventory of MAR schemes. The inventory contains information on site name, location, MAR type, year when the scheme came into operation, the source of infiltration water, the final use of abstracted water, and the main objective of the MAR scheme. This global MAR inventory is the resulting work from the IAH MAR commission and a team of researchers from several European institutions. New MAR sites and suitability maps will be uploaded to the portal as they come available.

MAR SUITABILITY MAPS

Regional MAR suitability maps are collected and shared through the portal. Specialists are encouraged to share regional maps indicating MAR suitability to improve accessibility to this information and to provide guidance for interested stakeholders.

Visit MAR Portal: marportal.un-igrac.org

REGIONAL MAPPING OF MAR SUITABILITY

MAR can be used to improve water security and resilience to droughts. The selection of suitable locations may however not be a simple task as there are many aspects which need to be considered. These include landscape characteristics, soil and aquifer properties, and the availability of excess surface water. The suitability for different MAR applications within the region can be identified and mapped to guide decision making where MAR intervention could be applied successfully.

One example of a regional mapping of MAR suitability is the project carried out by Acacia water and IGRAC for the transboundary Merti aquifer shared between Kenya and Somalia. The Merti aquifer is a large non-renewable aquifer that is one of the few reliable water sources in this semi-arid region. Both the local population and the growing number of refugees depend on groundwater. Based on remote sensing and GIS analysis, the map provides a first identification of MAR potential in the shallow aquifer. The available borehole data and geological literature were combined in order to create a conceptual model of the subsurface and provide guidance on the suitability of MAR for deep groundwater. The methodology for MAR suitability can be applied in other regions to complement policy on integrated water resources management and to assist implementing parties by providing a first-pass on scheme selection.



MAR IN-SITU ASSESSMENT

MAR potential maps provide a first-pass on MAR feasibility based on suitable landscape, (hydro)geology, and source water availability. Upon identification of suitable locations for MAR application, the following steps should be performed to groundtruth remote-sensing data and further assess MAR feasibility.

Sediment samples should be obtained from the candidate aquifer at frequent depth intervals and analysed in the lab in order to assess the geochemical reactivity of the aquifer. Aquifers containing highly reactive sediments should preferably be avoided as they may have negative implications on the quality of the recharged water. Depending on the planned MAR scheme, sediment samples can be obtained during the installation of injection and observation wells. Native groundwater samples should be collected and analysed in order to obtain a complete picture of the hydro-geochemical conditions in the aquifer. Source water samples should also be analysed to assess the chemical compatibility between the candidate aquifer and the source water intended to be artificially recharged and assess the reactions which may alter and compromise the quality of the recharged water.

Finally, reactive transport modelling can be a valuable tool assisting in identifying and quantifying the hydro-geochemical reactions and evaluating their temporal persistence.

IGRAC can assist carrying out these steps and can provide expert advice on the chemical compatibility between source water and candidate aquifers and on the selection of the most suitable MAR scheme depending on the local geochemical conditions.

MAR NETWORKS AND COOPERATION

IGRAC is participating in various MAR networks. These networks are set up to increase awareness on MAR techniques and solutions among water specialists and the general public, and to facilitate international exchange of information, by disseminating results of research and practical experience, and by undertaking joint projects and activities.

IAH-MAR Commission

The main objective of the MAR Commission of the International Association of Hydrogeologists (IAH-MAR) is to promote MAR through encouraging "research, development and adoption of improved practices for MAR". The Com-



mission facilitates exchange of information between members internationally, disseminates results of research and practical experience (via conferences and workshops) and raises awareness of MAR among IAH members and the water community. recharge.

Website: recharge.iah.org/recharge/

EIP Water Action Group: MAR(Solutions) to MAR-ket

MAR(Solution) to MAR-ket is an action Group under the European Innovation Partnership (EIP). The group focuses



on strategies and actions to bring Managed Aquifer Recharge scientific based solutions and techniques to the industry. It does this by promoting MAR to the principal stakeholders and SMEs. By transferring the results of MAR into guidelines and policy it enables successful MAR implementations to other locations.

Website: www.eip-water.eu/MAR Solutions

3R INITIATIVE

3R stands for "Recharge, Retention and Reuse of Groundwater & Rainwater".



3R is both an approach and an initiative that deals with the management of the water storage. It is a result of four Dutch entities (RAIN, Acacia Water, MetaMeta and Aqua for All), the German Geological Survey (BGR) and IGRAC joining forces in their attempts to contribute in climate change adaptation measures.

Website: www.bebuffered.com



IGRAC, YOUR PARTNER IN MAR

The International Groundwater Resources Assessment Centre (IGRAC) facilitates and promotes international sharing of information and knowledge required for sustainable groundwater resources development and management worldwide. IGRAC's mission is to contribute to the worldwide availability of relevant information and knowledge on the groundwater resources of the world, with particular emphasis on developing countries. IGRAC's goals are to support the sustainable utilisation and management of groundwater resources, to promote the role of groundwater in integrated water resources planning and to elucidate the impact of groundwater on ecosystems. IGRAC has experience in MAR research at both local and regional level. IGRAC can assess the hydrogeological, hydro-geochemical and socio-economic feasibility of MAR schemes in various aquifer settings and for various purposes and provide expert advice on the means of implementation.

If you would like to contribute MAR data to be shared within the MAR Portal please contact us for more information. It is also possible to obtain your own dedicated web-GIS portal to improve the outreach and to increase visibility of MAR projects. Web-GIS portal gives the possibilities to facilitate easy information access and exchange between project partners and other stakeholders.



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IGRAC'S MANAGED AQUIFER RECHARGE ACTIVITIES