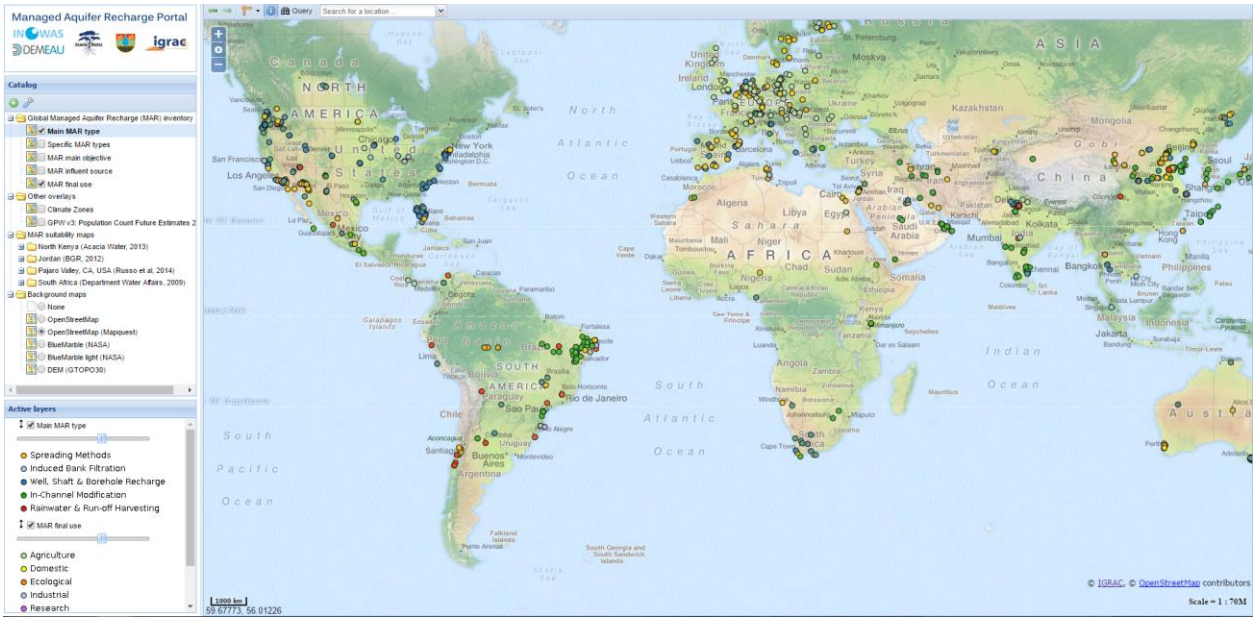
User manual MAR Portal

marportal.un-igrac.org

To increase the availability and facilitate continuous update of the MAR inventory, a MAR web-GIS portal is developed and integrated into IGRAC's Global Groundwater Information System (GGIS). The GGIS is an interactive, web-GIS portal to groundwater-related information and knowledge. The main purpose of the GGIS is to assist in collection and analysis of information on groundwater resources and its sharing among water experts, decision makers and public. The GGIS consists of several modules structured around 6 themes, including one theme on Managed Aquifer Recharge. The MAR theme has its own portal (http://marportal.un-igrac.org) with underlying database to allow storing and visualizing the global MAR data in a systematic way.

By facilitating access and promoting international sharing of information and knowledge on MAR, the web-GIS MAR portal encourages stakeholders to regard MAR as a viable solution for sustainable groundwater resources development and management.



Contents

MAR Portal

The MAR portal consists of a data layer catalog, a map viewer to visualize the selected data on a geographic location and a features panel to provide tabular output of the selected data. Additional information for each (point) location, such as references, can be displayed in the feature info. The portal allows to generate new pieces of information by creating overlays of map layers (mar suitability maps, or other overlays) and to build queries on the data. Data can be shared via download functionalities in the system or by making use of the web services. The MAR portal is freely available online and can be accessed without the prerequisites of any GIS knowledge or software licenses.

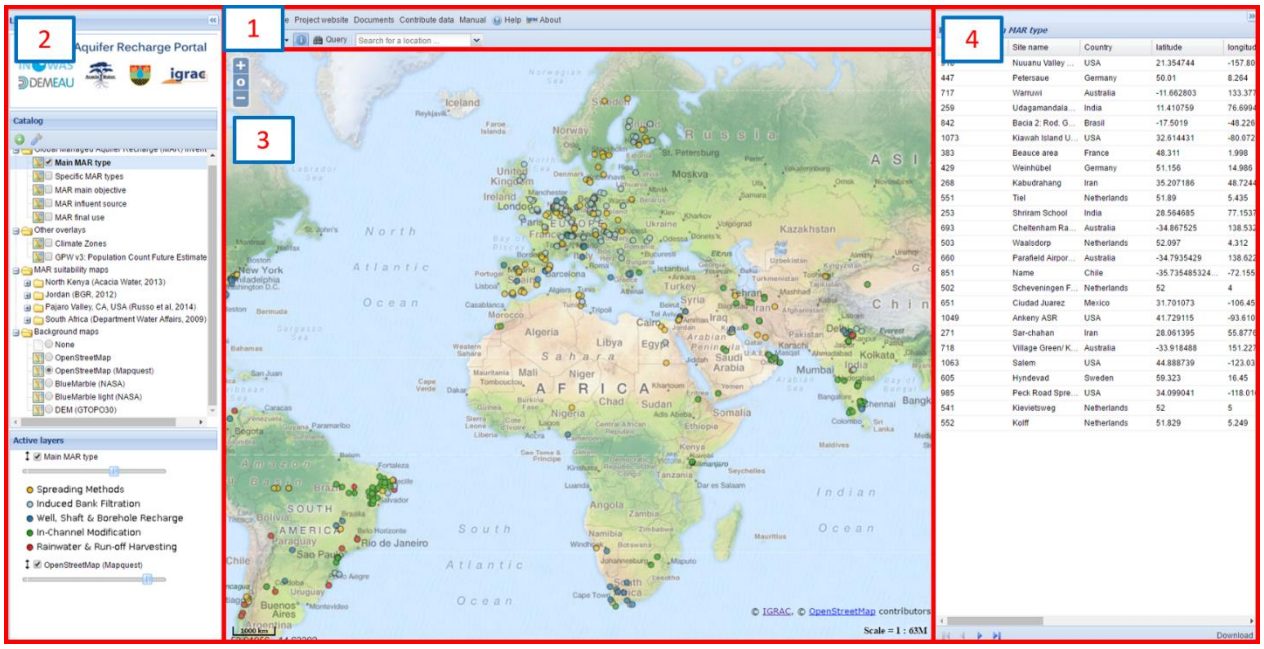
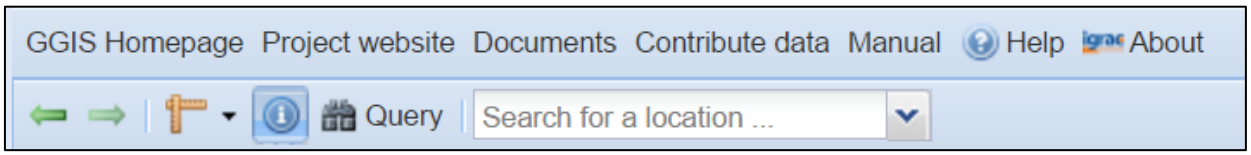


Figure 1. Viewer interface of the GGIS

1. **Main menu and tools**
2. **Layer panel**
   - Catalog, containing all map layers with data structured in a systematic way
   - Active layers panel, indicating which layers are currently visible and the associated legends. The layer panel can be opened or closed by using « in the upper left corner
3. **Map view** to visualize the selected data on a geographic location
4. **Features panel** provides tabular output of the selected data. The feature panel can be opened or closed by using « in the upper right corner.

1. Main menu and tools

The main menu is located on the top above the map view. It consists of the following tools:



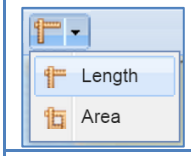
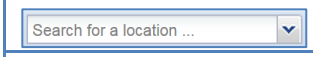
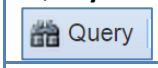
Icon	Description
GGIS Homepage	Select *'GGIS Homepage'* to go back to the start screen of the GGIS
Project website	Select *'Project website'* for more information on the MAR inventory
Documents	Select *'Document'* to go to MAR related documents in the Meta Information Module
Contribute data	Select *'Contribute data'* for instruction how to contribute data
Manual	Select *'Manual'* to get user manual on the MAR portal
Help	Select '*Help'* to find manuals on the GGIS.
About	*'About'* provides information on the GGIS platform
Zoom to extent	← Zoom to previous extent. → Zoom to next extent.
Measure 	Tool to measure a length or an area. - Measuring length on the ground with a line or path. - Measuring area with a polygon.
Search location 	'Search for a location' will zoom to the location you are looking for. You can search for cities, provinces and countries.
Feature info 	The feature info is activated by default. Click on a point on the map to return information about the features at that point.
Query 	Activate this tool and build advanced queries on attributes tables.
Add WMS layers 	The 'add layers' tool, visualized with  , can be used to add WMS layers from other sources.

Table 1. Functionalities within the main menu

Feature info

The feature info  is activated by default. When clicking on a point on the map, the feature info pop-up window will appear to return information about the features at that point (see Figure 2).

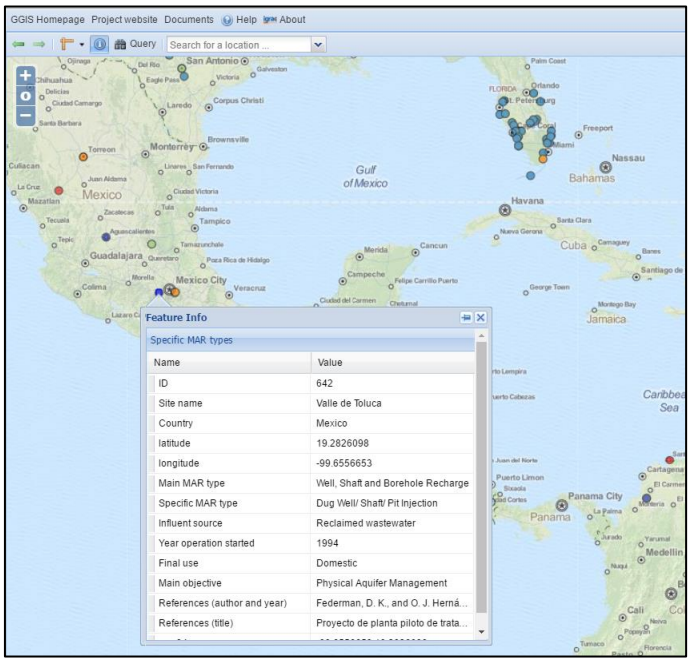


Figure 2. Example of additional information that can be obtained via the feature info screen

Query

Make a query on the data; you can see which locations match a specific condition. The query can be activated in two ways: by selecting 'query' in the main menu and tools (

) above the map panel or by right-mouse click on the layer in the catalog. The query is only available when there is a layer active (selected from the catalog).

Query examples

Below various examples are given how the query could be used. Please note that the query is sensitive to capital. Therefore please use the same description as provided in the legends. You can query the data by adding one or more conditions. In the example below only the data will be shown that match ***all*** conditions. The queried data match the conditions 'main mar type = Spreading Methods' and 'main objective = Maximize Natural Storage'.

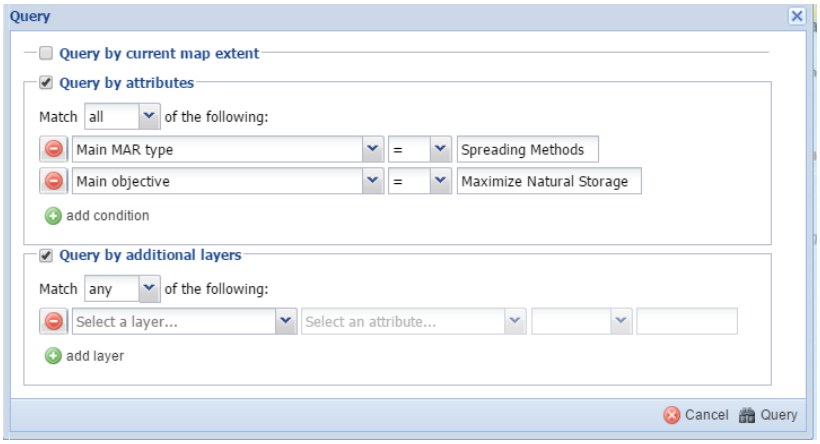


Figure 3. Query window

It is also possible to query the data that match ***any*** of the conditions. In the example below the queried data will match the conditions 'influent source = River water' or 'influent source = Lake water'.

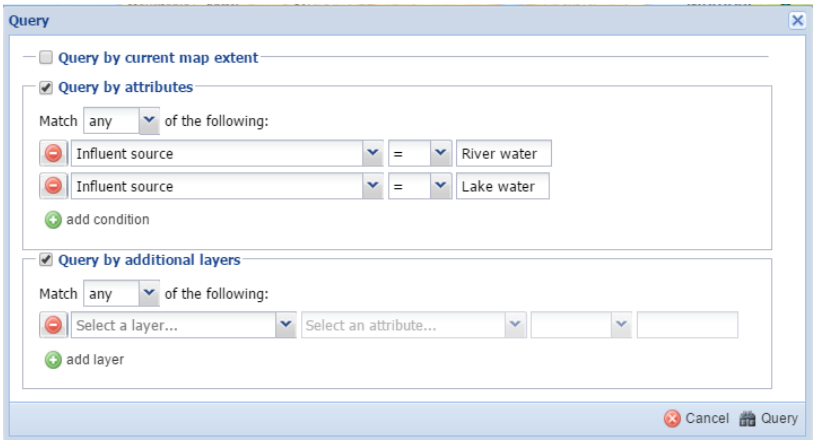


Figure 4. Query window

Contribute data

Specialists are encouraged to share information on MAR suitability maps and (new) MAR sites that are not yet included in the portal. Also if you have information to update and correct site data in this database, please get in touch and help us to improve access to information on MAR sites. You can find the excel template to include data on the website (link) Please contact us via marportal@un-igrac.org.

Add WMS layers

Because the system is using Open Geospatial Consortium (OGC) standards, it is very easy to add map layers from external sources to the viewer making use of WMS layers. WMS (Web Map Service) is a standard protocol for serving georeferenced map images over the internet generated by a map server.

1. To add a map layer click on the green button 'add layer' in the left corner 
2. Select 'Add a new server' from the dropdown menu 'View available data from'
3. Enter the valid WMS server link (e.g. https://example.com/geoserver/wms)
4. Select 'Add server'
5. Select one or more layers you would like to visualize, and select 'Add layers'
6. The layers will be added to the catalog in the folder ‘other overlays’
7. Select 'Done' to close the WMS window

If the system supports the type of WMS layer, you can find the data within the folder 'other overlays'. Note: data added as a WMS layer can be displayed in the GGIS viewer. However, the WMS layer can only be displayed, functionalities, such as query, filter, download or feature info is not available for these layers

2. Layer panel

The layer panel is located on the left side of the viewer. The layer panel can be opened or closed using  . The layer panel consists of two components, **the catalog** contains all map layers structured in a systematic way and the **active layers** panel indicates which layers are currently visible in the viewer with the associated legends.

Catalog

The catalog contains a folder structure with all map layers. The icon in front of the layername provides information on the layer type (see table 1). To visualise data on the map, simply activate the layer by checking the little box in front of the name and the data are shown on the map. The legend of the map layer will be shown in the lower left section of the screen the ‘**Active layers’.**

Active layers

The active layer window indicates which layers are currently visible. For each layer it shows the layer title and the corresponding legend. Within the active layers there are controls to adjust how data is displayed in the map view.

Icon	Tool	Description
	Up/down arrows	Can be dragged to change the display order of the layers. The upper layer will also appear as the upper layer in the viewer. The up/down arrows can be used for creating clear map overlays.
	Checkbox	The checkbox in the active layer can be used to make the layer not visible; note that this will remove the layer from

		this panel. To make the layer active again, you have to select it again from the catalog.
	Transparency slider	The transparency slider changes the layer opacity from 0% (left) to 100% (right);

Table 2. Controls in the active layer panel

Context menu

A right mouse click on a layer in the catalog will open a context menu (see Figure 5). In table 3 a description is given for the 4 different options available in this context menu.

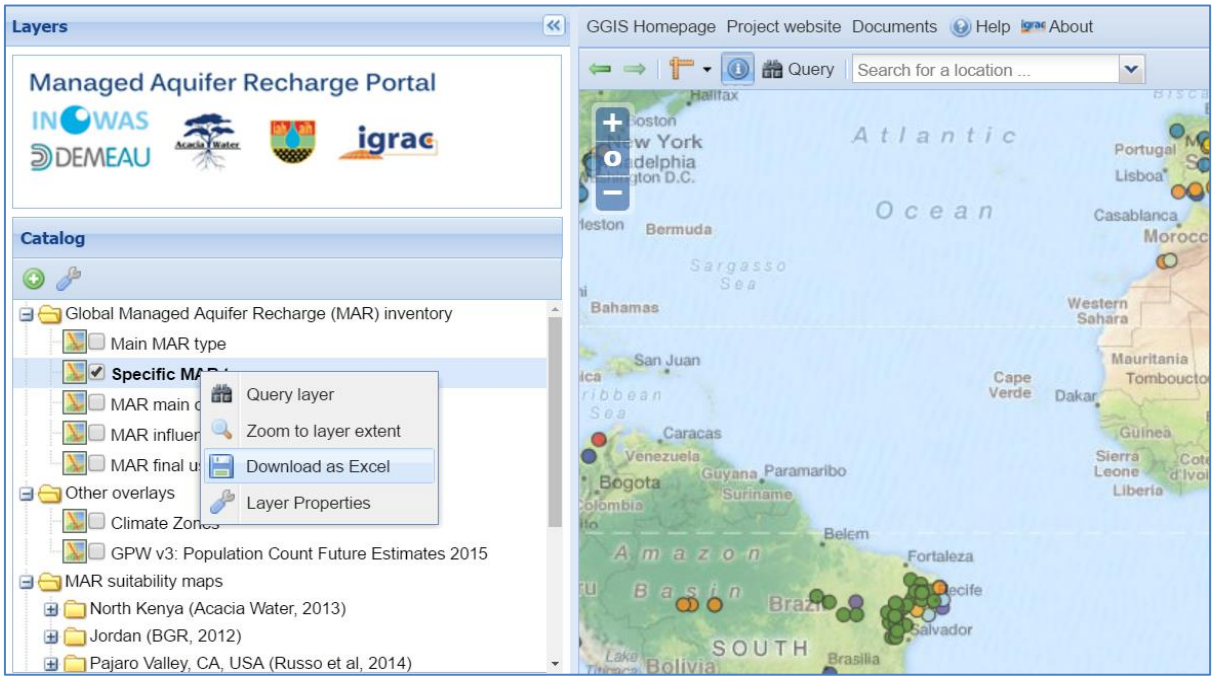


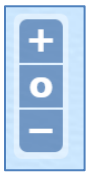
Figure 5. Right mouse click to open the context menu and to download the data in excel format

Tools	Description
a. Query	Query the data (see also '1. Main menu and tools)
b. Zoom to layer extent	This function will zoom to the extent of the selected map layer.
c. Download excel	The data can be downloaded as excel file for further processing offline
d. Layer properties	Provides meta information on the layers.

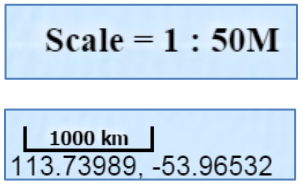
Table 3. Tools and description of the context menu

3. Map View

The Global Groundwater Information System uses the Mercator projection. As on all 2D map projections, shapes or sizes are distortions of the true layout of the Earth's surface. The Mercator projection exaggerates areas far from the equator.



Navigation tools allow you to zoom in and out and pan around maps. These tools are located in the corners of the Map View or by using the mouse. The map view is by default zoomed to maximum extent. The (+) and (-) allows you to zoom in and zoom out. The (o) will zoom to maximum extent.



In the lower right corner of the map you can find the scale. In the lower left corner of the view the scale bar is displayed with below the coordinates (longitude, latitude) of the location of the point of your mouse.

Useful shortcuts

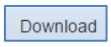
SHIFT-Drag allows zooming in.

Double-click allows zooming in.

Mouse-scroll zooms in with a forward scroll, or out with a reverse scroll.

4. Feature panel

The feature panel is located right of the map view. The feature panel can be opened or closed by selecting « in the upper right corner. Here the data of the selected layer will be shown in a tabular form. Note that the feature panel will be empty if there is no data selected.

Only 25 items (countries/regions) can be shown at the same time in the feature panel. You can find more data by going to the next page. (). It is also possible to sort data on alphabetical or numerical order, or to reshuffle the order of the columns. This can be done simply by selecting the column name and drag it left/right. The data can be downloaded by using the download button in the lower left corner (

). Note: if there is a query on the data, only the data that meets the query will be displayed in the feature panel.

Background information on Global inventory of MAR sites

The global MAR inventory is the result of a team of researchers from several European institutions. All case studies, except from Europe, were collected by a team at Technische Universität Dresden within the framework of the BMBF-funded project INOWAS (Innovative web-based decision support system for water sustainability under a changing climate). The European case studies were collected and analyzed by a consortium of researchers from Germany, Netherlands and Spain within the framework of the EU-funded project DEMEAU (Demonstration of promising technologies to address emerging pollutants in water and waste water). The visualisation of the MAR inventory on the GIS-based portal (GGIS) is provided by IGRAC, the project is supervised by the IAH-MAR Commission of the International Association of Hydrogeologists.

Currently available data layers in the MAR portal are Site name, country, location, year operation started, references, Main MAR type, specific MAR type, main objective, influent source and final use. The data is structured using the following classifications:

MAIN MAR TYPE		SPECIFIC MAR TYPE	
TECHNIQUES REFERRING PRIMARILY TO GETTING WATER INFILTRATED	Spreading methods	Infiltration ponds & basins	
		Flooding	
		Ditch and furrow	
		Excess irrigation	
		Reverse drainage method	
	Induced bank infiltration		
	Well, shaft and borehole recharge	Deep well injection	AS (TR)
			ASR
		Dug well/ shaft/ pit injection	
TECHNIQUES REFERRING PRIMARILY TO INTERCEPTING THE WATER	In-channel modifications	Recharge dams	
		Subsurface dams	
		Sand dams	
		Channel spreading	
	Runoff and rainwater harvesting	Barriers and bunds	
		Trenches	
		Rooftop rainwater harvesting	

Table 4. Classification of main and specific MAR types

Objectives	Type of infiltration water	Final use of abstracted water
ecological benefits	brackish water	agricultural
management of water	distilled water	domestic
distribution systems	groundwater	ecological
maximize natural storage	lake water	industrial
physical aquifer management	river water	
water quality management	storm water	
other benefits	tap water	
	wastewater	

Table 5. Classification of other MAR parameters used in the web-GIS portal