

Format for Biennial Reports by UNESCO's Water-related Centres on activities related to the IHP in the period (June 2014 – May 2016)

1. Basic information on the centre

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Location of centre		city/town _Delft_ country _Netherlands
Geographic orientation *		X global <input type="checkbox"/> regional
Region(s) (for regional centres)		
Year of establishment		2003 as a centre, 2011 as UNESCO II centre
Year of renewal assessment		2016 – in progress
Signature date of most recent Agreement		15 November 2011
Themes Of activities during reporting period	Focal Areas ·	<input checked="" type="checkbox"/> groundwater <input type="checkbox"/> urban water management <input type="checkbox"/> rural water management <input type="checkbox"/> arid / semi-arid zones <input type="checkbox"/> humid tropics <input type="checkbox"/> cryosphere (snow, ice, glaciers) <input type="checkbox"/> water related disasters (drought/floods) <input type="checkbox"/> Erosion/sedimentation, and landslides <input type="checkbox"/> ecohydrology/ecosystems <input type="checkbox"/> water law and policy <input type="checkbox"/> social/cultural/gender dimension of water <input type="checkbox"/> transboundary river basins/ aquifers <input type="checkbox"/> mathematical modelling <input type="checkbox"/> hydroinformatics <input type="checkbox"/> remote sensing/GIS <input type="checkbox"/> IWRM <input type="checkbox"/> Watershed processes/management <input type="checkbox"/> global and change and impact assessment <input type="checkbox"/> mathematical modelling <input type="checkbox"/> water education <input type="checkbox"/> water quality <input type="checkbox"/> nano-technology <input type="checkbox"/> waste water management/re-use <input type="checkbox"/> water/energy/food nexus <input type="checkbox"/> water systems and infrastructure <input type="checkbox"/> other: (please specify) _____
	Scope of Activities ·	<input checked="" type="checkbox"/> vocational training <input type="checkbox"/> postgraduate education <input type="checkbox"/> continuing education <input checked="" type="checkbox"/> public outreach <input checked="" type="checkbox"/> research <input checked="" type="checkbox"/> institutional capacity-building <input checked="" type="checkbox"/> advising/ consulting <input type="checkbox"/> software development <input checked="" type="checkbox"/> data-sets/data-bases development <input checked="" type="checkbox"/> other: (please specify) assessment

* check on appropriate box
 · check all that apply

Support bodies ¹	The Government of the Netherlands
Hosting organization ²	No
Sources of financial support ³	Core financing (The Government of the Netherlands) + projects (mainly with UNESCO-IHP)
Existing networks and cooperation ⁴	That would be a very long list
Governance	X director and governing board x other: (please specify) + foundation board Link to election of board members to the IHP Intergovernmental Council (IGC) and hosting country IHP National Committee Frequency of meetings: once every 1 year X Existence of UNESCO presence at meetings
Institutional affiliation of director	? IGRAC is legally independent organization
Number of staff and types of staff	total number of staff (full-time, or equivalent) : 7-8 number of staff who are water experts: 7-8 number of visiting scientists and postgraduate students: 0
Annual turnover budget in USD	800k€

2. Activities undertaken in the framework of IHP in the period June 2014 – May 2016

- 2.1 Educational activities (i.e., those with accreditation) that directly contributed to the IHP-VIII (Appendix 1) and WWAP
Please include here those activities which led to accreditation of degrees, or those held in formal school settings.
- 2.2 Research activities that directly contributed to the IHP-VIII activities
Please include research/applied projects outputs such as publications that directly contributed to the IHP-VIII and WWAP objectives
- 2.3 Training activities that directly contributed to the IHP-VIII and WWAP objectives

3. Collaboration and linkages

- 3.1 Participation in major international networks, programmes, partnerships with other UN or other International Agencies, media and professional bodies
- 3.2 Participation in meetings related to the IHP and UNESCO (e.g. the UNESCO General Conference, the UNESCO Executive Board, the IHP Intergovernmental Council and/or other meetings organized by IHP)
- 3.3 Collaboration and networking with other UNESCO category 1 or 2 institutes/ centres
 - 3.3.1 cross-appointment of directors of the category 1 or 2 institutes or centres on the governing board
 - 3.3.2 exchange of information on activities such as training/educational materials, and funding opportunities
 - 3.3.3 exchange of staff, most notably professionals and students

¹ please specify bodies that cover the operational costs of the centre, and other essential costs such as salaries and utility bills, and that provide institutional support to ensure centre's sustainability

² if different from support bodies

³ please specify sources of main budgetary and extrabudgetary funds to implement projects

⁴ please write international networks, consortiums or projects that the centre is part of, or any other close links that the centre has with international organizations or programmes, which are not already mentioned above

- 3.3.4 implementation of joint activities, such as workshops, conferences, training programmes, joint projects, field visits, software and data sharing, knowledge exchange and publications
 - 3.4 Relationships with the UNESCO field and regional office whose jurisdiction covers the country of location
 - 3.5 Relationship with the UNESCO National Commission and the IHP National Committee in the country of location and with other organizations of other countries
 - 3.6 Relationship with other UNESCO-related networks, such as UNESCO Clubs, ASPnet, and UNESCO chairs
- 4. Communication**
- 4.1 Communication and knowledge dissemination activities undertaken in the framework of IHP
 - 4.2 Policy documents and advice
- 5. Update on Centre Operations**
- 5.1 Membership of the Board of Governors between designated period
 - 5.2 Key decisions made (attach minutes of meetings)
- 6. Evidence of the Centre's Impacts**
- 6.1 Science Impacts (Major contributions to the science, technology, education, and regional and/or international cooperation in the field of water)
 - 6.2 Knowledge Transfer Impacts (Major achievements in the dissemination of knowledge and technology transfer)
 - 6.3 Policy Impacts (advice sought by government and other bodies and evidence of inputs into policy arena)
- 7. Future activities that will contribute directly to IHP and/or to WWAP**
- 7.1 Operational Plan (attach if available)
 - 7.2 Strategic Plan linked with IHP-VIII (Appendix 1). Focal areas within IHP-VIII the centre plans to contribute to and specific actions the centre will undertake to align its activities with the strategic plan for IHP-VIII
- 8. Annexes**
- 8.1 List of publications released by the centre (there can be overlap with those listed in 2.3 above)
 - 8.2 List of training courses conducted (there can be overlap with those listed in 2.1 above)

Appendix 1

Overview of the Core Programme Themes of the Eighth Phase of the IHP (2014-2021) WATER SECURITY: ADDRESSING LOCAL, REGIONAL, AND GLOBAL CHALLENGES

THEME 1: WATER-RELATED DISASTERS AND HYDROLOGICAL CHANGE

- Focal area 1.1 - Risk management as adaptation to global changes
- Focal area 1.2 - Understanding coupled human and natural processes
- Focal area 1.3 - Benefiting from global and local Earth observation systems
- Focal area 1.4 - Addressing uncertainty and improving its communication
- Focal area 1.5 - Improve scientific basis for hydrology and water sciences for preparation and response to extreme hydrological events

THEME 2: GROUNDWATER IN A CHANGING ENVIRONMENT

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

THEME 3: ADDRESSING WATER SCARCITY AND QUALITY

- Focal area 3.1 - Improving governance, planning, management, allocation, and efficient use of water resources
- Focal area 3.2 - Dealing with present water scarcity and developing foresight to prevent undesirable trends
- Focal area 3.3 - Promoting tools for stakeholders involvement and awareness and conflict resolution
- Focal area 3.4 - Addressing water quality and pollution issues within an IWRM framework - improving legal, policy, institutional, and human capacity
- Focal area 3.5 - Promoting innovative tools for safety of water supplies and controlling pollution

THEME 4: WATER AND HUMAN SETTLEMENTS OF THE FUTURE

- Focal area 4.1 - Game changing approaches and technologies
- Focal area 4.2 - System wide changes for integrated management approaches
- Focal area 4.3 - Institution and leadership for beneficitation and integration
- Focal area 4.4 - Opportunities in emerging cities in developing countries
- Focal area 4.5 - Integrated development in rural human settlement

THEME 5: ECOHYDROLOGY, ENGINEERING HARMONY FOR A SUSTAINABLE WORLD

- Focal area 5.1 - Hydrological dimension of a catchment– identification of potential threats and opportunities for a sustainable development
- Focal area 5.2 - Shaping of the catchment ecological structure for ecosystem potential enhancement – biological productivity and biodiversity
- Focal area 5.3 - Ecohydrology system solution and ecological engineering for the enhancement of water and ecosystem resilience and ecosystem services
- Focal area 5.4 - Urban Ecohydrology – storm water purification and retention in the city landscape, potential for improvement of health and quality of life
- Focal area 5.5 - Ecohydrological regulation for sustaining and restoring continental to coastal connectivity and ecosystem functioning

THEME 6: WATER EDUCATION, KEY FOR WATER SECURITY

- Focal area 6.1 - Enhancing tertiary water education and professional capabilities in the water sector
- Focal area 6.2 - Addressing vocational education and training of water technicians
- Focal area 6.3 - Water education for children and youth
- Focal area 6.4 - Promoting awareness of water issues through informal water education
- Focal area 6.5 - Education for transboundary water cooperation and governance



International Groundwater Resources Assessment Centre

WORK PLAN

2016



United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme



IGRAC WORK PLAN 2016

Delft, December 2015



International Groundwater Resources Assessment Centre

IGRAC (International Groundwater Resources Assessment Centre) facilitates and promotes international sharing of information and knowledge required for sustainable groundwater resources development and management worldwide. Since 2003, IGRAC provides an independent content and process support, focusing particularly on transboundary aquifer assessment and groundwater monitoring.

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LIST OF ACRONYMS

AGW-Net	African Groundwater Network
BGR	German Federal Institute for Geosciences and Natural Resources
BGS	British Geological Survey
CIWA	Cooperation in International Waters in Africa (World Bank trust fund)
CoP	Community of Practice
DGIS	Directorate-General for International Cooperation (Dutch Ministry of Foreign Affairs)
DIKTAS	Protection and Sustainable Use of the Dinaric Karst Aquifer System project
GCOS	Global Climate Observing System
GEF	Global Environment Facility
GGIS	Global Groundwater Information System
GGRETA	Groundwater Resources Governance in Transboundary Aquifers project, a new name for the SDC project
GGMN	Global Groundwater Monitoring Network
GTN-H	Global Terrestrial Network - Hydrology
HYCOS	Hydrological Cycle Observing System
IAH	International Association of Hydrogeologists
IFAS	International Fund for saving Aral Sea
IGAD	Intergovernmental Authority on Development
IHP	International Hydrological Programme
IMS	Information Management System
INWRMP	Inland Water Resources Management Programme
IW-LEARN	International Waters Learning Exchange and Resource Network
ISARM	Internationally Shared Aquifer Resources Management
IWMI	International Water Management Institute
MAR	Managed Aquifer Recharge
MIM	Meta Information Module (a GGIS component)
OGC	Open Geospatial Consortium
SADC	Southern African Development Community
SAP	Strategic Action Plan
SDC	Swiss Agency for Development and Cooperation, in the past also used to indicate the SDC funded GGRETA project
SIDS	Small Island Developing States
TWAP	Transboundary Waters Assessment Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
WB	World Bank
WFS	Web Feature Services
WHYCOS	World Hydrological Cycle Observing System
WHYMAP	World-wide Hydrogeological Mapping and Assessment Programme
WMO	World Meteorological Organization
WMS	Web Mapping Services
WPP	Water Partnership Program
WRI	Water Resources Institute

1. SUMMARY

IGRAC's Work Plan for 2016 - presented in this document - is in large extent a continuation of IGRAC's activities in previous years as well as in accordance with the IGRAC's Strategic Document 2012-2017. At the same time, this Work Plan was put together in anticipation of possible changes in coming year(s), both in terms of the focus of IGRAC activities and the financing of the Centre.

IGRAC is entering 2016 with a completely renewed Global Groundwater Information System (GGIS) that contains wealth of data and information collected and processed in various projects and other activities. Yet, development of some important GGIS components will continue and the new modules (e.g. on managing aquifer recharge) will be added as well. Since the three main transboundary assessment projects were completed in 2015, IGRAC is working to secure their follow up and to acquire new assessment projects. Nevertheless, transboundary groundwater assessment will certainly remain one of the IGRAC main activities. In 2016, we will also focus on large national aquifers in order to complete global aquifer coverage and provide at least basic indicators on importance and state of aquifers world-wide.

Global Groundwater Monitoring Network (GGMN) programme will receive an additional attention in 2016. Two major groundwater workshops and completion of the GGMN software were postponed for the next year and no further delay can be afforded. IGRAC involvement in monitoring of Sustainable Development Goals (SDGs) is an additional important impetus to speed up and extend GGMN activities. IGRAC will continue various activities meant to facilitate sharing of groundwater knowledge and increase public participation in groundwater governance. Innovative approaches will be tested and implemented, following contemporary development of media tools and services.

Next year IGRAC will mark its 5th anniversary as an independent foundation and as UNESCO category II centre. For IGRAC, this was a challenging phase of growing up as an independent organisation, a successful and rewarding period with a plenty of lessons learnt to implement in years to come. In 2016, IGRAC will undergo an external evaluation required for the anticipated renewal of the agreement between UNESCO and the Government of the Netherlands about the IGRAC Centre. The new agreement might bring changes (challenges and opportunities) in the IGRAC status within the UNESCO, as well as in financing of the centre. Nevertheless, the IGRAC Work Plan for 2016 is very ambitious, also because of rapidly growing awareness on importance of groundwater resources and on need of a global groundwater centre. Needless to say, the plans can be achieved only with full commitment of the IGRAC staff and the continuous support of the Government of the Netherlands and the United Nations.



2. ORGANISATIONAL/INSTITUTIONAL ACTIVITIES

This chapter contains an overview of the main organisational changes and institutional activities that are of vital importance for IGRAC's positioning and future. Similar to the last year's work plan, the chapter is extended with an overview of main project ideas and initiatives that will be further elaborated in the coming year. Some of them have been initiated in 2015 and may develop to projects in 2016; others are a reflection of new opportunities or have been in the pipeline for some time, waiting to be executed.

2.1 INSTITUTIONAL POSITIONING

In 2016 IGRAC will continue efforts to further strengthen the Centre's organisational structure as well as its links with various other institutes and programmes.

[UNESCO-IHP](#) will remain the main partner of IGRAC in 2016. UNESCO-IHP is IGRAC's natural partner considering that IGRAC was founded to assist UNESCO in the implementation of the International Hydrological Programme (IHP). In the last couple of years, both IGRAC and UNESCO-IHP made considerable efforts to develop the most optimal working relationship. The main obstacle is still the rather ambivalent position of UNESCO category II centres (like IGRAC): The UNESCO Water Division and the UNESCO-IHP Secretariat would like to see IGRAC as an integral part of UNESCO, while the UNESCO administration deals with IGRAC simply in the same way as with any other external (commercial) partner. This ambivalent position leads to complications in interpretations of agreements and contracts, different expectations and consequently reduced effectivity in common activities. There are other reasons that make execution of common activities challenging, the complexity of activities, organisational cultural differences, and working on distance being some of them. Nevertheless, the unclear status of IGRAC as a category II centre within the UNESCO family is the main impediment to more effective cooperation.

In 2016, the agreement between [UNESCO and the Netherlands](#) needs to be renewed. As a part of the renewal procedure, an evaluation of the IGRAC centre will be carried out. The evaluation report will have to clearly address all impediments of the collaboration and include suggestions for improvement and scaling up of common activities. A change of IGRAC status within UNESCO would require a change in regulations on UNESCO category II centres. This is a lengthy procedure that requires preparation and adoption of a resolution by UNESCO General Conference. The resolution should be widely supported by other centres and member countries. The alternative option worth considering is promotion of IGRAC into category I centre.

For a healthy future of IGRAC, active involvement in [World Bank](#) activities is of vital importance. Groundwater is gaining more attention at the Bank and IGRAC can play a significant role in World Bank projects all over the world. IGRAC has developed a number of products and services which can be used in the Bank's activities. In 2014 IGRAC was introduced at the Bank and since then IGRAC has been trying to engage in Bank activities, especially those supported by the Netherlands under the Water Partnership Programme (WPP) and the Cooperation in International Waters in Africa (CIWA) programme. Possibilities for IGRAC's involvement in these and coming projects also depends on priorities set by the [Ministry of Foreign Affairs Directorate-General for International Cooperation \(DGIS\)](#). Groundwater is often included in programmes but it is not a priority for DGIS; other water sectors related to flooding, sea water intrusion, sanitation, etc. receive much more attention. For 2016 IGRAC aims to use its network more effectively to bring groundwater higher on the priority list at DGIS. The new cooperation mechanism among three ministries in the Netherlands on the International Water Ambitions may prove to be promising for developments related to groundwater and IGRAC. IGRAC involvement in monitoring of Sustainable Development Goals (SDGs) could also be of interest for the Government, especially if the Government decides that the Netherlands will be one of so-called the Proof of Concept countries in the SDG monitoring process.

Cooperation with [WMO](#) intensified in 2015, and IGRAC aims to maintain this upward trend for 2016. In 2016 the WMO Manual on Water Resources Assessment will be finished and published. Furthermore, we are aiming for at least two joint training sessions on groundwater monitoring to be organised in the framework of the HYCOS and GGMN programmes. The first one for representatives of Small Island Developing States in the Pacific is currently in preparation and will be held in the first quarter of 2016.

In 2016 IGRAC will organise a regular meeting for the Foundation Board in April and for the Governing Board in December. A meeting of the Technical Advisory Committee (TAC) which has been postponed in 2015 should also take place once there is clarity about the future of the centre.

Last year (2015) did not see an increase of [IGRAC staff](#), and temporary contracts were only extended for a limited period again, due to insecurity related to funding of the centre in coming years. The potential for IGRAC to further increase its permanent staff will depend on the new agreement about IGRAC between the Government of Netherlands and UNESCO and also on success of project acquisition. IGRAC has ambitious plans and is committed to achieving these plans. The degree of success will however also depend on external factors like the support from UNESCO and WMO (to be involved in large externally funded programmes) and the continued support of the Government of the Netherlands (in terms of core funding after 2015).

2.2 NEW PROJECT IDEAS, INITIATIVES, AND LEADS

Project leads, new ideas and initiatives result in new activities and in the long run shape IGRAC's profile and strategic planning. It is not always obvious which lead to follow and which initiative is more promising than another. IGRAC is constantly expanding its network of partners and users of IGRAC products and services. This section gives an overview of the most promising leads and initiatives to be pursued in the coming year.

The [World Bank funded project 'Sustainable Groundwater Management in SADC Member States'](#) still remains as a major lead for IGRAC. The project start has been postponed several times due to administrative reasons and according to the latest information it will be launched before the end of 2015. The purpose of the project is to set up a Groundwater Management Institute which undertakes activities to support the sustainable management of groundwater at national and transboundary levels across SADC Member States. IGRAC contributed substantially to the preparation of the project document and is in regular contact with the World Bank about the progress. Finding the right modality for IGRAC engagement in the project still remains an issue.

Two Expressions of Interest (Eoi) for the [World Bank funded Zambezi River Basin Management Project](#) have been submitted in the last quarter of 2015: One for the 'Strategic Plan for the Zambezi Watercourse' with IMWI as the leading partner, in association with UNESCO-IHE, Antea (Belgium), Prime Africa (South Africa) and IGRAC. A second Eoi was submitted for the 'Zambezi Water Resources Information System (ZAMWIS) Enhancement 3: Hydro-Met Database and Decision Support System' with Antea (Belgium) as the lead organisation, in association with IMWI, UNESCO-IHE, and IGRAC.



IGRAC will explore opportunities for increased involvement in the monitoring of [Sustainable Development Goals \(SDGs\)](#) in the framework of Global Environmental Monitoring Initiative (GEMI). GEMI is the inter-agency initiative which deals with most of the water-related targets. IGRAC expects to contribute the most in relation to the target 6.5: 'By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.'

Some of the projects which IGRAC has been involved in over the last years might obtain a second phase. While [DIKTAS](#) and [GGRETA](#) projects are about to be completed in 2015, proposals for follow up have been prepared and discussed with involved countries and donors (see also section 3.2.2).

Some proposals have been prepared quite some time ago but are nevertheless still promising. Examples are the proposal '[Strengthening the institutional capacity of African Network of Basin Organization \(ANBO\)](#)', contributing to the improved transboundary water governance in Africa and the proposal 'Enabling Countries of the Transboundary Syr Darya Basin to make sustainable use of their groundwater potential and subsurface space with consideration to climate variability and change'. The ANBO proposal has been submitted to the Global Environment Facility (GEF), while

the Syr Darya proposal awaits political acceptance of all project countries.

Groundwater in [Small Islands Developing States \(SIDS\)](#) is one of IGRAC's new focal areas. IGRAC started to build up its portfolio on SIDS through the TWAP project where groundwater information of 43 Small Island Developing States worldwide was collected. In 2016, IGRAC aims to further analyse and assess the collected data of SIDS groundwater systems and produce related publications. IGRAC will also conduct a workshop on groundwater monitoring and assessment in cooperation with WMO. Possibilities to stronger link SIDS related activities with WMO and UNESCO programmes will be further investigated.

IGRAC is currently exploring possibilities to join the existing [Delta-MAR consortium](#) that evaluates the potential for Managed Aquifer Recharge (MAR) in saline aquifers in Bangladesh. The consortium consists of UNICEF, four universities from the Netherlands and Bangladesh and the Dutch consultant Acacia Water. The consortium has already constructed over 100 MAR systems in Bangladesh. The project's objective is to determine financial, institutional, environmental, technical, and social prerequisites for the successful regional-scale, self-propelling, and sustainable implementation of MAR systems in urbanizing, saline deltas. One of the main goals is to use a Geographic Information System to map locations with varying degrees of (potential) MAR success for the Bangladesh saline delta and for similar deltas worldwide. The potential role of IGRAC to assist in the development of such system is currently being discussed with TU Delft and Utrecht University.

IGRAC has recently been approached by a non-profit organisation [LEAD-Pakistan](#) regarding potential IGRAC involvement in the planning processes to form a commission to study transboundary issues in the 'Indo-Pak border'. The city of Lahore is surrounded by agricultural areas which use intense farming methods including heavy and largely unregulated use of pesticides. Lowering of the groundwater table causes inflow of groundwater from surrounding areas. Lahore city (over 5 million residents) faces problems with contaminated water and the suspicion is that contamination may be caused by use of pesticides across the border, barely 10 KM away from Lahore. The study aims at determining to what extent the groundwater contamination can be attributed to transboundary sources and to what extent to local sources. IGRAC and LEAD are currently discussing the viability of ideas and methodologies that can be used and identifying regional and international partner institutions.

FUND / CLIENT	PROGRAMME / PROJECT	STUDY LOCATION	PARTNERS	STATUS
Angola Instituto Nacional de Recursos Hidricos	Sustainable development of the Cuvelai-Etosha transboundary aquifer (Angola and Namibia)	Angola (and possibly Namibia)	Deltares	Project idea on hold
GEF / UNDP	Determining parameters of the aquifer underlying Mt. Kilimanjaro for sustainable development and management, factoring in effects of climate change	Kenya, Tanzania	UNESCO	Project identification phase
GEF / UNDP / ANBO	Strengthening the institutional capacity of African Network of Basin Organization (ANBO), contributing to the improved transboundary water governance in Africa	Africa (ANBO/AM-COW)	UNESCO	Proposal submitted
GEF / UNEP	Improving IWRM, knowledge-based management and governance of the Niger Basin and the lullemeden-Taoudeni/Tanezrouft Aquifer System (ITTAS)	Algeria, Bénin, Burkina Faso, Mali, Mauritania, Niger and Nigeria	UNESCO	Proposal submitted
IGAD	Transboundary Aquifer Assessment in the IGAD Region	IGAD region	IGAD, Ministry of Water Kenya	Project idea submitted
Kenya - Water Resources Management Authority	Hydrogeological study in Kenya – Mandera County	Kenya	Acacia Water, Earth Water Ltd	Proposal submitted
WMO	Advancing Groundwater Monitoring in Small Island Developing States in the Pacific	Pacific SIDS	SPC, SPREP	Project initiated
World Bank / Brazil	Hydrogeological study of the North-Central region of the State of Tocantins	Brazil	Acacia Water, Panaoá Consult	EoI submitted
World Bank / ZAMCOM	Zambezi River Basin Management Project – component: Strategic Plan for the Zambezi Watercourse'	Zambezi Basin	Lead: IMWI Subconsultants: Antea group, UNESCO-IHE, PRIME AFRICA	EoI submitted
World Bank / ZAMCOM	Zambezi River Basin Management Project – component: Zambezi Water Resources Information System (ZAMWIS) Enhancement 3: Hydro-Met Database and Decision Support System	Zambezi Basin	Lead: Antea group Subconsultants: IMWI, UNESCO-IHE	EoI submitted

Overview of current project acquisition activities – relevant for 2016 planning

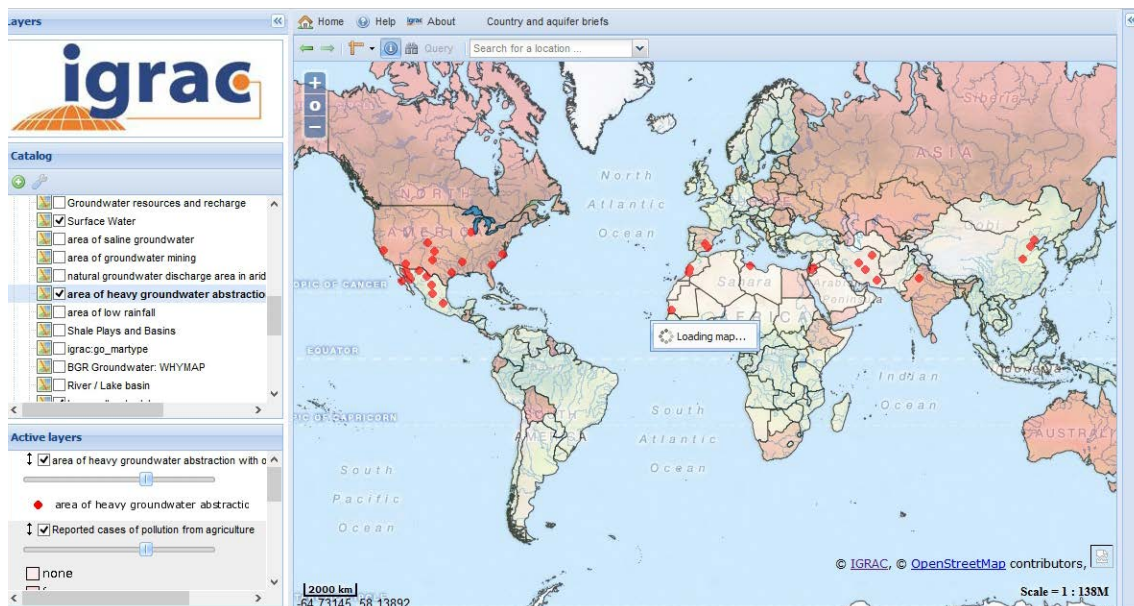
3. CONTENT ACTIVITIES

IGRAC content activities in 2016 will mostly be a continuation of activities from previous year(s), and in accordance with the IGRAC Strategic Planning (2012-2017). New ideas and initiatives, as described in the previous chapter, will most likely widen the scope of IGRAC's work in the next year. Nevertheless, the main activity structure can remain the same as in previous years:

- Global Groundwater Information System
- Global Groundwater Assessment
- Global Groundwater Monitoring Network
- Groundwater Knowledge Sharing and People Networks

3.1 GLOBAL GROUNDWATER INFORMATION SYSTEM (GGIS)

The Global Groundwater Information System (GGIS) is IGRAC's interactive web-portal to groundwater related information and knowledge. The main purpose of the GGIS is to assist in collection, storage and analysis of information on groundwater resources and its sharing among stakeholders like water experts and decision makers. The system is modular in set-up and provides amongst others a global overview of aggregated information per country and per aquifer; detailed information for a selection of transboundary aquifers; and information sheets for 199 recently assessed transboundary aquifers. The map interface of the GGIS is complemented with a Meta-Information Module (MIM), where additional information and references are uploaded which are linked to the other data in the system. The software developed for monitoring (the GGMN application) and other IGRAC online databases are also considered a part of the GGIS.



3.1.1 Software development

For 2016, IGRAC is planning to continue development of the GGIS to further improve the system and extend the GGIS with additional functionality. Software development will also include new modules required for IGRAC projects. In the first quarter of 2016 we aim to finalise the development of a completely redesigned GGMN.

[Development of new module for the RAMOTSWA project](#)

Within the RAMOTSWA project (see section 3.2.2) IGRAC will be responsible for setting up an aquifer information management system (status of project in early November 2015: contract under negotiation). The Ramotswa IMS will be set-up as a new module in the GGIS, much alike the system for the GGRETA case studies. Depending on how the project develops, IGRAC might also get additional project funds through USAID to develop additional tools and functionality in a 2nd phase of the project after 2016.

[Development of a new module for the Groundwater Atlas of Africa](#)

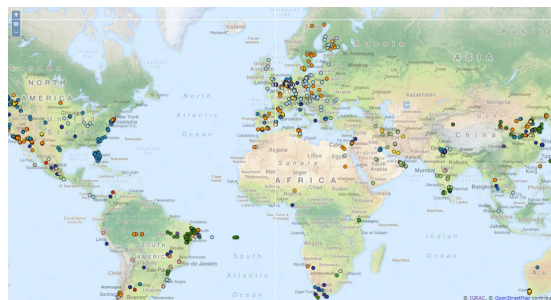
For the project 'Groundwater Atlas of Africa' the British Geological Survey (BGS) has gathered data and produced systematic overviews of groundwater related data for each country in Africa (data on geography, geology, hydrogeology and groundwater use & management). BGS has set up the atlas as a Wikipedia, but was also looking for tools to disseminate the maps (as GIS files) and for a long-term solution to keep the collected data and information available on-line. Therefore, IGRAC will develop, in close cooperation with BGS, a GGIS module to facilitate sharing of the data/information gathered by the BGS. This new module will contain various thematic maps per country as well as downloadable information sheets per country. A special feature in this module will allow the user to download the data in a GIS format (shapefiles). IGRAC has suggested to BGS to host and maintain not only map information but the whole Groundwater Atlas of Africa in the GGIS. It is anticipated that this module will be developed in the second quarter of 2016.

[Development of the GGRETA Information System](#)

The Groundwater Resources Governance in Transboundary Aquifers (GGRETA) project – phase 1 will be finalised by the end of 2015. In the phase 1, IGRAC developed for each of the case-study transboundary aquifers a dedicated portal to store, visualise and share information between relevant stakeholders in support of transboundary groundwater governance. UNESCO has recently (October 2015) developed a proposal for a possible Phase 2 of GGRETA to which IGRAC hopes to contribute. In this phase there may be a possibility to further develop and populate the information management system to facilitate sharing information between countries and stakeholders. The proposal also includes 'development of a joint and harmonised modern multi-purpose aquifer monitoring database' for which the newly designed GGMM could be deployed.

[Development of Managed Aquifer Recharge Information System](#)

IGRAC has reinforced its role in the IAH MAR working group in 2015 and aims to continue being actively involved in the group in 2016. One of the targets of the IAH working group is to develop a knowledge hub including an online MAR viewer. In 2016 IGRAC will launch the MAR portal as part of the global MAR knowledge hub. The MAR viewer will display the status of MAR internationally and will include maps of MAR sites globally with information on water type, aquifer type, type of recharge method, purpose of MAR etc (see also section 3.1.2 and 3.2.3).



[Redesign of the Global Groundwater Monitoring Network portal](#)

In 2016, we will be launching the redesigned web-application for the Global Groundwater Monitoring Network (GGMN), which was commissioned in 2015 (for ca 100.000). Improved functionality of the GGMM include performance, user-friendliness, use of international standards, improved visualisation of data availability in space and time, improved visualisation of groundwater change and spatial aggregation. New functionalities include a time series analysis tool, inclusion of a digital elevation model, land cover maps, download functionality, multiple log in per country or organisation and automatic import via web services.

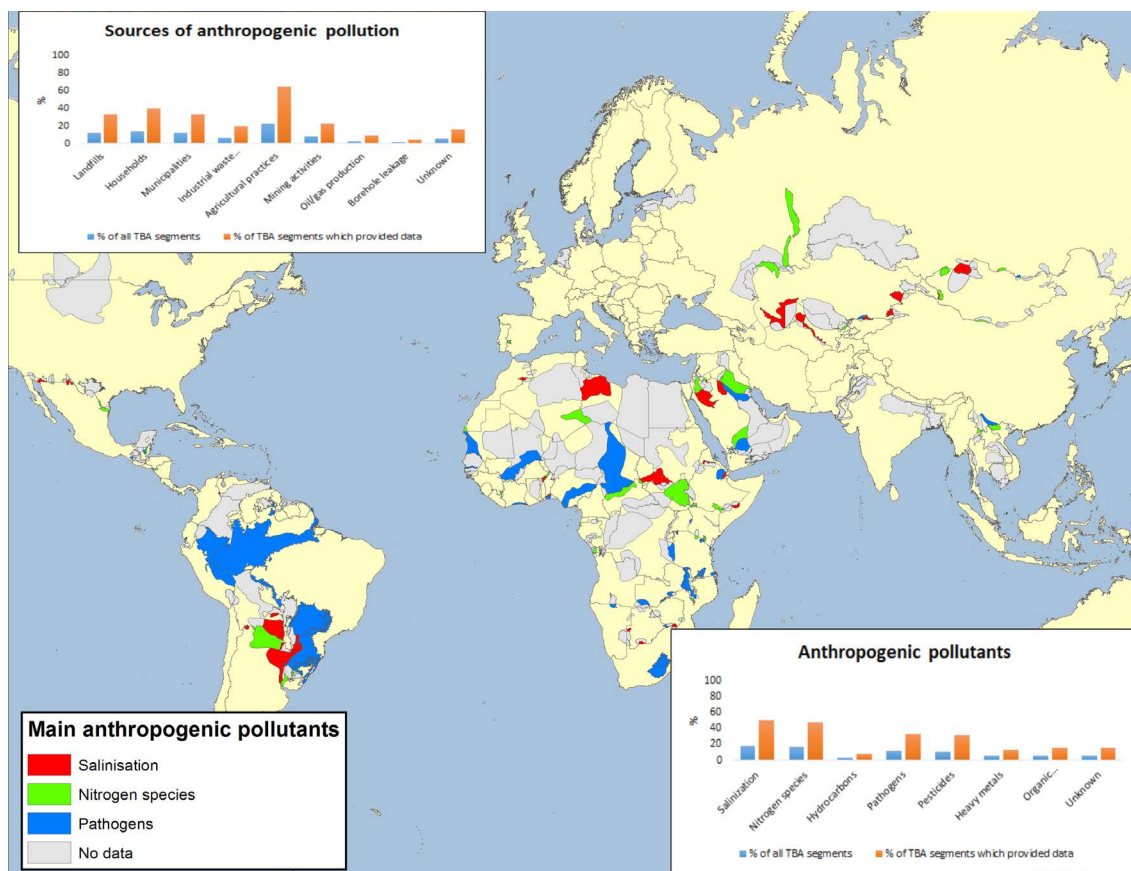
3.1.2 Content update

The content update listed below is an integral part of GGIS applications but not the exclusive; the most of IGRAC services and products described in the chapter 3 will be made available via GGIS modules as well.

[Transboundary Aquifers](#)

A wealth of data has been collected in the framework of TWAP. All information directly related to the questionnaires and indicators has already been made available in the GGIS-TWAP module in 2015.

However, even more data have been provided, like thematic maps, cross-sections and reference material. IGRAC aims to make relevant additional information available via the TWAP module in 2016 (provided the information is of sufficient quality). In 2016 IGRAC will also explore possibilities to fill



the gaps on some of TWAP indicators (see section 3.2.3). Once complete these data will also be made available via the GGIS.

[Inventory of Managed Aquifer Recharge Sites](#)

The GGIS already contains information collected through a European Union project consortium in the DEMAU project. The information consists of point data with information on MAR sites in Europe. Additional data are available from a global inventory on MAR Sites by the TU Dresden, Germany. This database contains data on 1500 MAR sites worldwide, with for each site key information on construction, operation and aquifer properties. The first data have been added to the system in 2015. Additional data will follow in 2016 and will be made available via the MAR portal (in the GGIS). The MAR portal will be included in the global MAR knowledge hub, which is to be launched at the ISMAR9 conference in 2016.

[Global overview and Meta Information Module \(MIM\)](#)

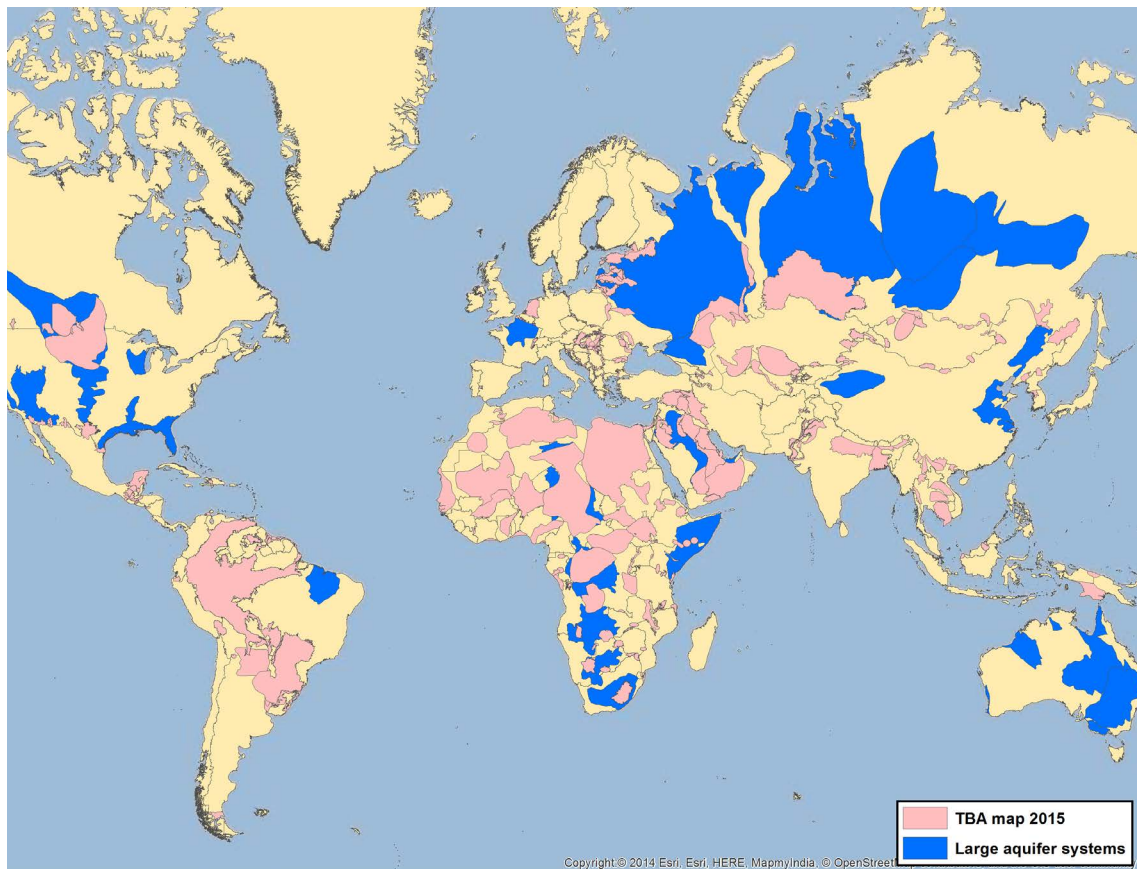
IGRAC will continue to update and expand the content of these two GGIS modules whenever possible. Data in the system will be checked for inconsistencies and/or updated with new information.

[Open Geospatial Consortium \(OGC\) Web Services](#)

The new GGIS makes possible an easy data upload from external sources using OGC web services. At the same time, data in the system can easily be shared with other groundwater information systems (and their users). To do this, the GGIS uses Web Mapping Services (WMS) to distribute maps and Web Feature Services (WFS) to distribute data. In 2016, IGRAC aims to make data and maps from in the last years produced articles and reports available in the new GGIS, thereby integrating existing information in a user-friendly and interactive information system. It will also explore other information systems with groundwater related maps that can be integrated in the system via the Web mapping services.

[Large national aquifers](#)

IGRAC will continue to collect groundwater-related information which is relevant to be shared on a global level. To complete the global picture on groundwater resources worldwide, IGRAC will expand the focus from collecting information on transboundary aquifers to also collect key information on large national aquifers (see 3.2.3).



3.2 GLOBAL GROUNDWATER ASSESSMENT

Groundwater assessment activities at IGRAC encompass a country-based assessment, (trans-boundary) aquifer-based assessment and thematic assessments. Already in 2003, IGRAC started with a global country overview, mostly because the most of information on groundwater has been available on country-level. In meantime, thanks to transboundary assessment activities (and especially the TWAP project), IGRAC collected substantial info on internationally-shared aquifers. Since IGRAC's long-term ambition is to provide a global overview of aquifer-based information, IGRAC has also started to collect selected info on large national aquifers in the last quarter of 2015 and this work will continue in 2016 as one of the main IGRAC's internally initiated activities.

3.2.1 Global Country-based Assessment

Country briefs and the Groundwater Atlas of Africa

In past years IGRAC has developed several country-based groundwater descriptions. These country briefs are brochures (3-5 pages) providing an overall picture of the country's groundwater resources presented in standardised way in short narrative supplemented with some graphical information. For 2015 IGRAC planned to develop more country briefs with the ultimate goal to create briefs for all countries in the world. Due to priorities in external projects progress has been limited. Through contacts with the British Geological Survey (BGS) there is an opportunity to move forward for the African countries: The BGS has recently published the results of a project called 'Groundwater Atlas of Africa' in which they present data on the hydrogeology of the African countries in a structured way. IGRAC and BGS reached an agreement on cooperation and IGRAC will set up a new module in the GGIS to make this information – and especially the maps - available through the web.

Country-based Groundwater Assessment

The World Bank would like to develop a standard procedure for assessment of groundwater resources country-wide, yielding information relevant for their lending operations. IGRAC was asked to participate in a brainstorm session organised by the bank in November 2015 where possible approaches were discussed, basically combining mapping, remote sensing, modelling and GIS processing. If the bank decides to proceed with this activity in 2016, IGRAC will most likely be asked

to participate, bringing in its experience with the country-based overview but also with transboundary groundwater assessments.

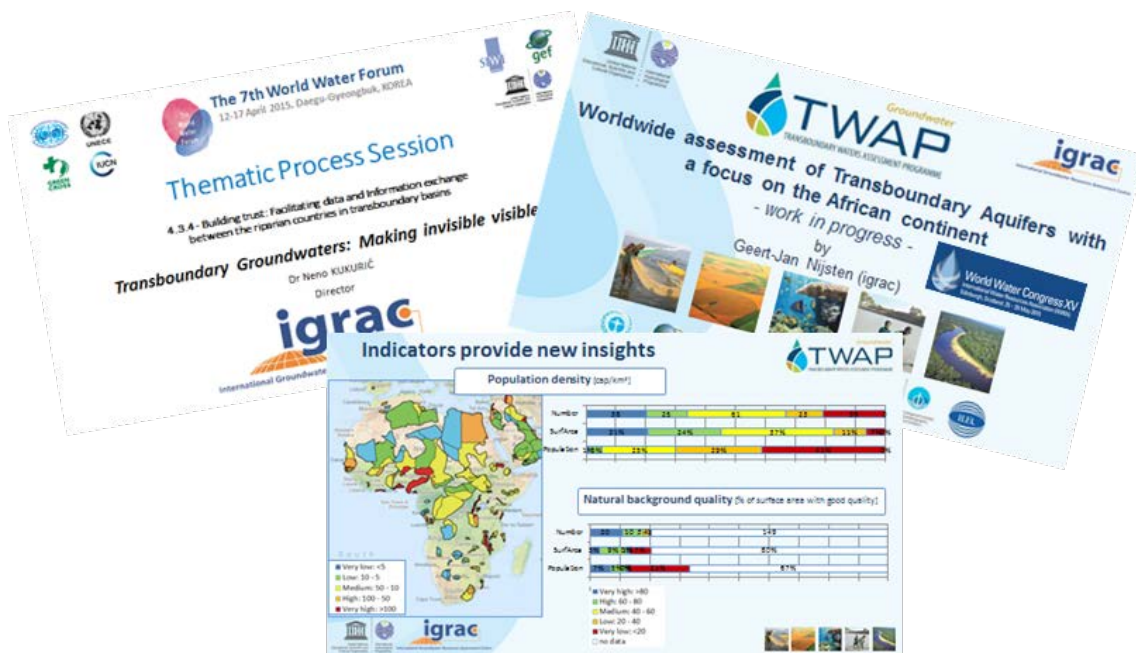
3.2.2 Transboundary Aquifers Assessment

Transboundary Aquifers Assessment will remain an important activity of IGRAC in 2016 although the major projects TWAP, DIKTAS and GGRETA are rounded off in 2015. While preparations for a new DIKTAS and GGRETA phase are on-going in cooperation with UNESCO-IHP, IGRAC is also intensively looking for new opportunities for assessment of transboundary aquifers. IGRAC's assessment methodology and the GGIS applications make IGRAC services attractive for various kinds of regional groundwater assessments as was proven by IWMI's invitation to take part in the RAMOTSWA project (see below for description of these activities). The most promising initiatives are already listed in the chapter 2.2. IGRAC will also continue to work on TWAP, maintaining, analysing and improving its outcomes.

Transboundary Water Assessment Programme (TWAP)

Recognizing the importance of transboundary water systems to humans and ecosystems, the fact that many of the water systems continue to be degraded and that most are managed in fragmented ways, the Global Environment Facility initiated the Transboundary Water Assessment Programme (www.geftwap.org). IGRAC was involved in the TWAP medium-sized project (2009-2011) in which the methodology for an indicator based assessment was developed. In 2013 the TWAP full-sized project started. This programme is the first global comparative assessment of five transboundary water system categories: groundwater, lakes, rivers, large marine ecosystems and open oceans. The project has provided the GEF and other international organizations with tools and information for setting priorities in activities related to sustainable management of transboundary water systems. The TWAP groundwater component (www.twap.isarm.org) assessed 199 transboundary aquifers and 43 groundwater systems of Small Island Developing States. Data were collected through networks of regional and national experts. The project was executed by UNESCO-IHP in close cooperation with IGRAC.

The project has formally closed in 2015, and as a consequence the official TWAP activities of IGRAC have come to an end. Having committed to the long-term maintenance of the TWAP Groundwater Information Management System (TWAP-IMS) and TWAP being so closely related to IGRAC's core activities, IGRAC is planning to still undertake 'TWAP related' activities in 2016 (partly using internal funding):



- IGRAC will continue to maintain the TWAP Information Management System: The TWAP-IMS is part of IGRAC's GGIS and as such will benefit from newly developed functionality. Also in terms of data management IGRAC is committed to continuously improve and expand the TWAP Groundwater database whenever possible. This can be by uploading additional information received from external parties or by improving / adding information obtained through IGRAC activities.
- Execution time of TWAP was limited and the large amounts of data collected in TWAP warrant further in-depth analyses. Given the short time span and deadlines of TWAP, only a limited analysis of the data has been possible in the framework of TWAP itself. This analysis focussed on the indicator results from TWAP. Therefore IGRAC initiated an internal project for in-depth analyses of the TWAP Groundwater data sets in order to maximise data mining of this important data set on transboundary groundwater. The in-depth analyses also includes analyses of some of the background data (the 'raw' data from the questionnaires) in order to evaluate in more detail the current condition and vulnerability of transboundary aquifers. The final product (format still to be decided) will be ready in 2016 and aims to further inform potential donors and the scientific community about the state of the transboundary aquifers of the world and to assist in the design of new interventions and allocation of funds.

DIKTAS project

In 2016, preparations for a new phase of the DIKTAS (Protection and Sustainable Use of the Dinaric Karst Aquifer System) project will take place. DIKTAS (<http://diktas.iwlearn.org>) was the first GEF project executed by UNESCO. IGRAC has provided the project manager and also contributes to various content activities.

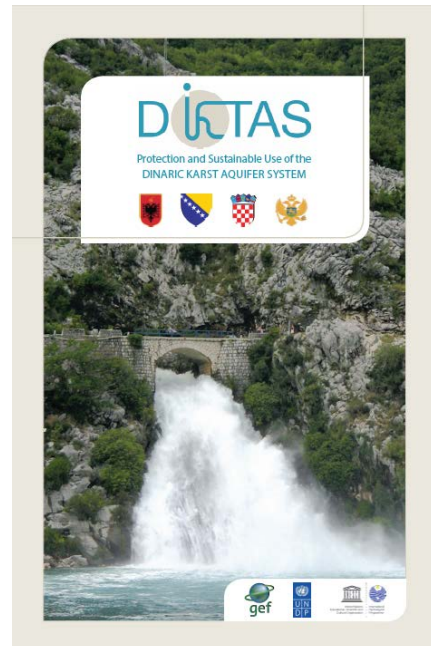
The DIKTAS project received an extension until December 2015 and at the time of writing of this work plan, most planned activities were carried out with exception of preparation of a concise version of the Strategic Action Plan (SAP). This SAP version needs to be submitted to the project countries for consideration and hopefully adoption. For the beginning of 2016 visits to the countries are planned to support this process. The intention is to include Serbia in the project, together with Albania, Bosnia and Hercegovina, Croatia and Montenegro. Croatia is not eligible for GEF funds anymore and efforts to find co-funding for Croatia will continue in 2016.

Once the countries adopt the SAP or at least endorse the proposed activities, a project proposal for the inception phase needs to be submitted to the GEF for approval. The proposal can however be prepared in advance, in anticipation of the countries endorsement. Next year a full project document will be prepared and hopefully the project Inception meeting will also be held in the course of 2016. On behalf of UNESCO (as the project execution agency), IGRAC will play a leading role in these activities.

GGRETA project

Phase I of the project GGRETA (Groundwater Resources Governance in Transboundary Aquifers) project started in April 2013 and ran until December 2015. It was funded by the Swiss Agency for Development and Cooperation (SDC) and executed by UNESCO-IHP with IGRAC as a major partner. The objectives of the project were:

- to improve the knowledge and recognition of the importance and vulnerability of transboundary groundwater resources;
- to establish cross border dialogue and cooperation;
- to develop shared management tools;
- to facilitate governance reforms focused on improving livelihoods and economic development and environmental sustainability.



In 2015 SDC commissioned an external review of SDC's "Water Diplomacy and Governance in Key Transboundary Hot Spots" Programme. This is the programme under which GGRETA was funded and GGRETA was included in the external evaluation. Findings of the external evaluator, Adelphi, were critical but positive.

“The reviewers find that the continued funding of the five partial actions is well-justifiable.”

- External reviewer GGRETA Project -

Following this positive outcome of the review, SDC requested from UNESCO-IHP to prepare a concept note for a 2nd phase of GGRETA (with IGRAC contributing to the concept note) and was later asked to develop this concept note into a full proposal, which has been submitted to SDC in October 2015. UNESCO has proposed a second phase with a duration of 3 years (2016-2018) and an estimated budget of 1,880,000 CHF. Work in the three case study transboundary aquifers will continue. The envisaged outcomes of the project are:

- **Outcome 1** - Improved resource knowledge and monitoring based on recognition of the importance and vulnerability of transboundary groundwater resources.
- **Outcome 2** - Enhanced cross-border dialogue and cooperation based on development of shared management tools, and recommendations for governance reforms focused on improving livelihoods, economic development, gender equality and environmental sustainability.
- **Outcome 3** - Improved capacity in groundwater governance, hydro-diplomacy and gender, and effective communication aiming at replication of project experiences and approaches.

IGRAC is hoping to contribute to the project, whereby the logical focus would be on activities related to outcome 1. IGRAC contribution is depending on approval of the proposal by SDC and UNESCO-IHP to engage IGRAC in the execution.

“The UNESCO GGRETA approach to use technical assessments and data sharing as an entry point or basis for transboundary water cooperation has shown to be successful mainly in Southern Africa, where riparian countries are committed to cooperation. However, the issue of transboundary aquifers is deemed very relevant and the work that has been taken place on assessing aquifers in Central America and Central Asia is important in the regions and should be complemented with increased efforts to build trust, stakeholder engagement and developing capacities in hydro-diplomacy.”

- External reviewer GGRETA Project -

Ramotswa Transboundary Aquifer Project

Already in December 2014 the International Water Management Institute (IMWI) invited IGRAC as a partner to the project 'Resilience in the Limpopo Basin: the Potential Role of the Transboundary Ramotswa Aquifer'. This project, funded by USAID is a component of the Resilience in the Limpopo Basin Program (RESILIM) which supports the riparian countries of the basin (Botswana, Mozambique, South Africa, Zambia) in their efforts to improve shared management of water resources and equitably address the economic, environmental, and social needs of each country, thereby enhancing the resilience of the ecosystems and the people. The project supports equitable access to water that balances urban and rural needs with ecosystem requirements under a changing climate. It reduces climate vulnerability by promoting adaptation strategies for integrated,



transboundary water resource management. By building the capacity of river basin organizations, national authorities and local communities to sustainably manage natural resources, high priority ecosystems and human communities will be resilient to climate-induced pressure.

The Ramotswa project addresses the overall objectives by critically examining the role and options that the freshwater aquifer offer in terms of adaptation to climate variability and human induced changes, while preserving and enhancing the resource and associated ecosystems through transboundary and local management.

IGRAC's formal involvement in the project started only in November 2015 and this first phase will continue until December 2016 (a 2nd phase until 2018 is currently under negotiation). IGRAC's contribution to the first phase will be to set-up and manage the Ramotswa aquifer information system in the GGIS, to provide training in three workshops on the use of the system and on assessment as well as contribute to the analyses and reporting and possibly to scientific papers resulting from the project.

[Transboundary Aquifers of the World Map](#)

No major update of the map of Transboundary of the World is planned for 2016. In 2015 IGRAC made digital versions of the map available via the GGIS. This enables IGRAC be much more flexible and to digitally publish updates of the map even when the amount of new information is limited. In 2016, IGRAC will hence improve and update the (digital version of) the map if and when new information on transboundary aquifers becomes available. It is also IGRAC's ambition for to work out and visualise as much as possible the 3-D element of aquifers and to elucidate the overlapping of aquifers.

3.2.3 Thematic Assessment

In IGRAC Thematic Assessments, a specific groundwater issue or topic (such as a research methodology or a specific type of groundwater pollution) is assessed or studies in more detail. In 2016, IGRAC will finalise some thematic assessments initiated in 2015, and in 2016 IGRAC will also look for opportunities to collaborate with partner institutes in conducting new thematic assessments.

[Guidelines for Multidisciplinary Assessment of Transboundary Aquifers](#)

In 2015 IGRAC - in cooperation with UNESCO-IHP - published 'Guidelines for Multidisciplinary Assessment of Transboundary Aquifers'. The guidelines document was launched in draft form during

the 42nd IAH congress in Rome in September 2015. Organisations and individuals working/interested in transboundary aquifers have been invited to comment and/or contribute to the guidelines. In the first half of 2016 we will bring the IGRAC and UNESCO-IHP authoring team together in order to finalize the guidelines. Accordingly, the final version of the guidelines will be published next year. We are also working on a publication for a peer reviewed journal (in co-authorship with UNESCO-IHP) under working title: 'Enabling groundwater governance: a multi-disciplinary approach for transboundary aquifers assessment at a global and local scale'.

[From TBAs to Global Coverage - inclusion of large national aquifers](#)

In 2015, IGRAC has started to work on a map and database of Aquifers of the World, by complementing the map of Transboundary Aquifers of the World with data on large national aquifers. In addition to creating a map with delineations of the (large) aquifers of the world, we also aim to collect/estimate data for two indicators describing the state and importance of each aquifer; these are groundwater development stress (available recharge vs groundwater abstraction) and human dependency on groundwater. Information required for the calculation of these indicators may be available at aquifer level (preferably) or at national/subnational level (like total water withdrawals, required for the calculation of human dependency). If latter, the values need to be rescaled onto aquifer level.

Sources of aquifer-based information include the TWAP database, literature and the IGRAC/UNESCO network of regional and national organisations and specialists. National and subnational data will be collected from online databases of national statistical bureaus, geological surveys and similar. Collection of data will begin with the countries with the highest total groundwater use.

[Managed Aquifer Recharge](#)

Managed Aquifer Recharge will remain one of the focal areas of IGRAC in 2016 and therefore a several activities are planned.

IGRAC has reinforced its role in the IAH MAR working group in 2015 and aims to continue being actively involved in the group in 2016. One of the targets of the IAH working group is to develop a knowledge hub including an online MAR viewer. The MAR viewer will display the status of MAR internationally and will include maps of MAR sites globally with information on water type, aquifer type, type of recharge method, purpose of MAR etc. In 2015, IGRAC has started development of the knowledge hub on MAR on the IGRAC website. IGRAC will expand the knowledge hub and its outreach in 2016 in cooperation with the IAH working group. Additional data on MAR sites are expected to be obtained in the second half of 2016. The MAR knowledge hub will be launched at the ISMAR9 conference (20-24 June 2016, Mexico City).

IGRAC will strengthen its cooperation with the 3R Consortium and MARtoMARKET but also further explore cooperation with TU Delft; in the last quarter of 2015 ideas have been exchanged between IGRAC and TU Delft on potential involvement on a number of projects including DeltaMAR in Bangladesh, MAR projects in Mozambique and possibly MAR projects in India.

Groundwater resources can be part of the solution to provide water in times of drought. IGRAC intends to thoroughly investigate the potential of using MAR to mitigate the impacts of droughts in focus countries such as Brazil, India, China and selected countries in the Sahel. The link with current programs, especially of WMO, World Bank, UNESCO and the Government of the Netherlands will be investigated. In 2015 a project proposal has been prepared for the semi-arid North Eastern part of Brazil to find suitable sites for MAR application. Several organisations in Brazil have shown interest and contributed to the proposal. MAR is not commonly applied in Brazil, there have only been a few test cases. In 2016 IGRAC will search for financing opportunities to implement this proposal.

[Groundwater Economy - Water accounts and the value of groundwater](#)

In October 2015 IGRAC had a meeting with 'Statistics Netherlands' (Centraal Bureau voor de Statistiek - CBS) to explore possible cooperation on 'water accounts' with a focus on groundwater. CBS has developed environmental and water accounts for the Netherlands. The water accounts follows an internationally agreed methodology which is laid down in the 'System of Economic and Environmental Accounts' (SEEA) and negotiated with the United Nations Statistics Division (UNSD).

The System of Environmental-Economic Accounting is an international statistical system that brings

together economic and environmental information in a common framework to measure the contribution of the environment to the economy and the impact of the economy on the environment. In 2016 IGRAC and CBS want to further explore how this methodology can be combined with IGRAC's groundwater assessment projects and how this can assist in water governance in developing countries. One of the potential entry points is the World Bank WAVES project (Wealth Accounting and the Valuation of Ecosystem Services). The other possibility for cooperation could be in the framework of SDG monitoring, in a case if the Netherlands becomes one of the SDG 'Proof of Concept' countries.

[Analysis of TWAP SIDS data](#)

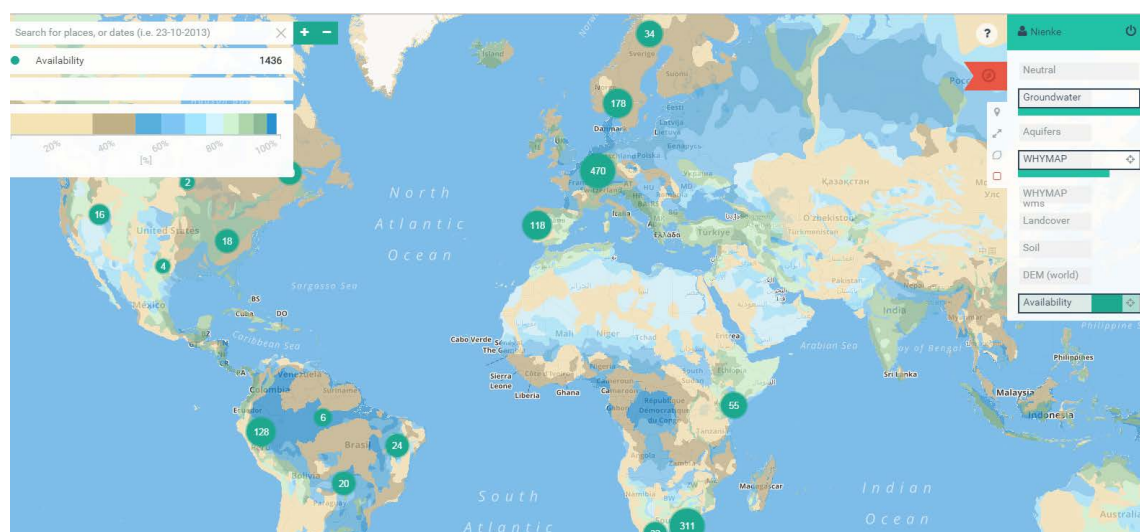
Small Island Developing States (SIDS) have limited options for developing their freshwater resources and are highly vulnerable to the effects of climate change. Given the high level of human dependency on groundwater in these states, the Transboundary Waters Assessment Programme included, besides transboundary aquifers, also the groundwater systems of 43 SIDS. The Simon Fraser University (SFU) completed an extensive literature survey in the framework of TWAP. Data from the literature survey were complemented by data collected through questionnaires. Unfortunately the majority of these questionnaires were returned too late for SFU to include the questionnaires in their TWAP analyse. IGRAC aims to use the completed questionnaires addressing aquifer properties, socio-economic aspects and environmental issues, received from national experts of 30 states, to conduct a detailed assessment following an approach similar to one developed for transboundary aquifers. The SIDS analysis project will be published as an (technical) IGRAC report (an IGRAC publication) or a peer-reviewed publication.

3.3 GLOBAL GROUNDWATER MONITORING

The Global Groundwater Monitoring Network (GGMN) is a participative, web-based network of networks, set up to improve quality and accessibility of groundwater monitoring information and subsequently our knowledge on the state of groundwater resources. GGMN is a UNESCO programme, implemented by IGRAC and supported by many global and regional partners.

In 2015, IGRAC started with a complete redesign of the GGMN web-application. In the first quarter of 2016 the software developments for the GGMN will be finalized. The new system is built using state of the art technology and will meet the requirements of international standards for data sharing. The system is more robust and user friendly which will enable GGMN users to work independently with the system.

The improved GGMN can also be used as a tool in specific projects or programmes. The new system allows multiple users access to the same workspace (multiple login per country). Additionally, data do not necessarily have to be stored per country workspace but can also be connected to (transboundary) aquifers, organisations or projects. Another new component that will be added to the GGMN is a time series analysis tool. This time series analysis tool which will allow users to gain more insight in groundwater system dynamics has been developed by UNESCO-IHE.



With the development of the new GGMN application, IGRAC is expecting to reach more organisations and institutes that would like to participate in the GGMN network and share groundwater data internationally. In 2016, connecting the GGMN with countries worldwide will be one of IGRAC's main targets. The GGMN will be embedded in several external IGRAC projects: the GGMN will be used as a data management component for the GroFuture project (see section 3.4.1) and possibly also for the RAMOTSWA project – phase 2 (see section 3.2.2).

IGRAC also aims to increase the use of GGMN data by third parties in regional and global groundwater studies. Accordingly, the data sharing principles with third parties will be simplified and the GGMN data sharing functionality expanded.

IGRAC will continue to organise GGMN-related workshops to strengthen and expand the GGMN People Network. In the first half of 2016 IGRAC will organize, in partnership with WMO, a 4-day training workshop on 'Advancing Groundwater Monitoring in Pacific Small Island Developing States (SIDS)'. The workshop is developed in the framework of the WMO Hydrology and Water Resources programme and the IGRAC's Global Groundwater Monitoring Network (GGMN) programme. The purpose of the workshop is: to bring together regional groundwater specialists involved in day-to-day groundwater monitoring activities from the Pacific Small Islands Developing States (SIDS); to review the state of groundwater resources and monitoring in the Pacific SIDS; and to identify challenges, critical development needs, and possible solutions. The Global Groundwater Monitoring Network programme will be introduced and its possible relation to groundwater monitoring in Pacific SIDS.

A second GGMN workshop in 2016 will be held in Thailand in the first half of the year. The workshop is organized in collaboration with UNESCO-Bangkok, and the Department of Groundwater Resources of Thailand. The 2-day workshop will bring together groundwater specialists from Thailand and Republic of Korea. During the workshop, the groundwater experts will become familiar with the GGMN programme and will start to use the newly developed GGMN web-based application, including data upload, processing and visualization of groundwater levels. The workshop aims to provide a platform to discuss groundwater monitoring challenges in Southeast Asia as well as to exchange information, experience and perspectives on groundwater monitoring networks.

3.4 KNOWLEDGE SHARING AND GOVERNANCE

Knowledge sharing is a part of all IGRAC activities and involves creating/strengthening networks of people and development/improvement of services for these networks (e.g. via web portal or social media). These activities are dedicated to knowledge sharing (beyond the usual management structure) including public participation in groundwater governance. In the chapter below, distinction is made between activities (mostly project-based) and dissemination and outreach through publications, social media, events, etc.

3.4.1 Governance

Sustainable Development Goals (SDGs)

In September 2015 the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development, which includes 17 Sustainable Development Goals with 169 associated targets. The new Goals and targets will come into effect on 1 January 2016 and will guide the decisions of UN organisations and member states over the next 15 years.



A clear set of indicators and a coherent monitoring framework is required to track progress of achieving the SDG targets. The Global Environmental Monitoring Initiative (GEMI) is set up to address this need for the Sustainable Development Goal 6: 'Ensure availability and sustainable management of water and sanitation for all'. GEMI is an inter-agency initiative composed of the United Nations Environment Programme (UNEP), the United Nations Human Settlements Programme (UN-Habitat), the United Nations Children's Fund (UNICEF), FAO, UNESCO, the World Health Organization (WHO) and WMO, co-operating under the umbrella of UN-Water.

IGRAC is contributing to the GEMI and will focus on information needed to compile the indicators to measure the targets 6.4: 'By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity' as well as target 6.5: 'By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate'. Target 6.5 is particularly relevant for IGRAC: Under the leadership of UNEP, UNECE and UNESCO-IGRAC, the GEMI monitoring initiative will provide a basis for monitoring indicator 6.5.2 'Percentage of transboundary basin area with an operational arrangement for water cooperation'.

After the SDGs come into effect, IGRAC will release its final position paper in the three-part series on Groundwater and the Sustainable Development Goals. This paper will focus on the role of groundwater in the final language of the SDGs. It will also look at implementation and monitoring of the goals through a groundwater lens.

[Groundwater Futures in Sub-Saharan Africa \(GroFutures\)](#)

GroFutures is a project (lead by the University College of London) that aims to develop the scientific basis and participatory processes by which groundwater resources can be used sustainably for poverty alleviation in Sub-Saharan Africa. Work is focussed around 3 focal 'Basin Observatories' comprising the Upper Awash (Ethiopia), Great Ruaha (Tanzania), and Iullemeden (Niger/Nigeria/Benin/Burkina Faso). IGRAC participates in this four-year research project. The project is supported by a grant from the Programme Unlocking Groundwater's Potential for the Poor (UpGro), which is jointly funded by UK's Department for International Development (DFID), Natural Environment Research Council (NERC) and the Economic and Social Research Council (ESRC).

IGRAC has two roles in the project:

1. The project Information Management Strategy will employ IGRAC's Global Groundwater Monitoring Network to disseminate the results of the project;
2. IGRAC will help decision makers and stakeholders to transparently consider trade-offs associated with development pathways by improving and applying the Groundwater Serious Game 'Tragedy of the Groundwater Commons' (GW-GAME).

For 2016 three field visits are planned to the project's river basins: Upper Awash (Ethiopia), Great Ruaha (Tanzania), and Iullemeden (Niger/Nigeria/Benin/Burkina Faso). During these field visits IGRAC will conduct the Play & Dialogue sessions for the GW-GAME with several stakeholders: These will mainly be policy-makers, but community leaders will also be invited to participate in these sessions. Due to the political situation and safety reasons, the GW-GAME session in the Iullemeden basin will probably be held in Niamey - Niger. Also in 2016 IGRAC will set up the GGMM interface for GroFutures to store and share the project's data sets.

[Serious Groundwater Game](#)

In the past IGRAC developed a serious game titled Improved Cooperation on Groundwater Management. The game has been tested and further developed under the GroFutures project, and will be played in the workshops under this project. Beyond the scope of the GroFutures project, IGRAC would like to make the groundwater-game also available to a wider audience. To do so, the game requires a more user friendly interface, and possibly also incorporating some more advanced concepts (like groundwater depletion). IGRAC wants to cover the development costs through crowd-funding. This approach will generate visibility of IGRAC, create a platform for potential users of the groundwater game and allow IGRAC to explore this relatively new approach to fund raising.

['Groundwater-wise WASH' tool](#)

By using available hydrogeologic, demographic and technological information, this tool aims to make WASH-projects 'groundwater-wise'. The longstanding international push to increase access to WASH services world-wide combined with the Sustainable Development Goals, emphasizes the need to develop and design WASH projects in a way that takes into account both groundwater availability and vulnerability. The project aims to engage partners and potential donors, such as UNICEF and Rotary International. The tool will combine existing IGRAC capacities with global, regional, and local knowledge and data. It will look at groundwater use efficiency, background quality, and vulnerability in order to give guidance on appropriate techniques and technologies based on geographic

and cultural contexts. We plan to assess the viability of the initiative by the first quarter of 2016 and (if the concept is considered to be viable) to have a pilot tool available by the end of the year.

[Traineeship on Groundwater and Disaster Risk Management](#)

Already in 2015 IGRAC planned host a trainee from the Ministry of Infrastructure and Environment, who would complete a six-month intensive study of the role of groundwater in disaster risk management and disaster relief. We hope to carry out this training in 2016. The primary output will be a report that provides a background on water-related disasters focusing on floods and droughts. It will inventory and highlight the role of groundwater in these disaster scenarios (e.g. potable and agricultural water supply) and potential consequences to the resource (e.g. pollution of shallow groundwater during floods). An assessment of global and regional, policy and planning mechanisms as well as technological interventions will follow. The study may also highlight examples, and to the extent possible, best practices in disaster risk management, choosing one case for flooding (e.g. the Netherlands) and another for drought. The report will conclude with recommendations for integrating groundwater issues into disaster risk management. The full report will be published by IGRAC and a concise version of the report may be submitted to a peer-reviewed academic journal, if the trainee so desires.

3.4.2 Knowledge Sharing Activities

[FREEWAT](#)

FREEWAT (Free and open source software for water resources management) is a HORIZON 2020 project financed by the EU Commission under the call Water Innovation: Boosting Its Value For Europe. FREEWAT aims at promoting water resource management by simplifying the application of the Water Framework Directive and other EU water related Directives. FREEWAT main result will be an open source and public domain GIS integrated modelling environment for the simulation of water quantity and quality in surface water and groundwater with an integrated water management and planning module.

IGRAC's main role in the project will be to participate in capacity building and to promote the use of FREEWAT at the Stampriet case study area at the Orange River Basin. The next step within the FREEWAT project will be training of the professionals involved in the project. This activity will take place in the first half of 2016. Afterwards dissemination workshops are going to be organized. IGRAC will be working in cooperation with UNESCO-IHP in order to prepare data and the training for the Orange River Basin in Southern Africa.

[WMO manual on Water Resources Assessment](#)

IGRAC is contributing to the WMO Manual on Water Resources Assessment. The manual is developed to provide the National Hydrological Services and other operational agencies with state of the art methods for assessing the water resources availability and potential of its exploitation at the national, subnational or regional scale in support of Integrated Water Resources Management. The manual will deal with both surface and groundwater resources. It is expected to have a peer-reviewed manual published by the end of 2016. IGRAC will contribute to the manual with one chapter and a case study on groundwater resources assessment and will review the entire manual to ensure groundwater is included as an integral component in each chapter.

[IW LEARN 2016](#)

In April 2016, Phase 3 of IW LEARN will draw to a close and Phase 4 will commence. IGRAC anticipates engaging with UNESCO-IHP for reporting and other closing activities for the current phase at the beginning of 2016. Phase 4 will bring increased and improved interaction with the Global Groundwater Community of Practice through the IGRAC forum, webinars, and face-to-face meetings. Phase 4 will focus on sharing experiences and best practices for the purposes of capacity building. This goal will be achieved through three selected themes, especially related to groundwater governance.

[Capacity building and education](#)

Even though it is not one of IGRAC's core activities, IGRAC aims to contribute to capacity building in groundwater monitoring, assessment and governance through specialized training workshops and on-the-job training.

IGRAC is one of the associated partners of the new Erasmus Mundus Programme on Groundwa-

ter and Global Change - Impacts and Adaptation (GroundwatCh). This Joint Master Programme started in 2015 and is delivered by IST Lisbon (Portugal), UNESCO-IHE (the Netherlands) and TU Dresden (Germany). IGRAC will contribute to the semester organised by IGRAC's in-house partner UNESCO-IHE and will provide supervision to MSc students.

[Water accounting](#)

The lack of access to data in international basins is cause for great concern. There is an urgent need for independently gathered water resources-related data sets that can be commonly understood by hydrologists, economists, agronomists, environmentalists, social scientists, legal experts and political scientists, and that enable evidence-based decision support and policy making. A system of water accounting has so far been missing in the emerging framework of global water governance. UNESCO-IHE, the International Water Management Institute (IWMI) and the United Nations Food and Agriculture Organization (FAO) joined forces to develop research in global water accounting.

IGRAC will be involved in this research through a project aiming to distinguish and quantify the groundwater use based on total water use information and data from remote sensing. The research will be performed as a PhD study at UNESCO-IHE, while IGRAC will provide at least data and feedback and ideas during various stages of the 4-year project. IGRAC's role will be defined in more detail end of 2015/beginning 2016.

[The ISARM \(Internationally Shared Aquifer Resources Management\) programme](#)

ISARM (www.isarm.org) includes transboundary assessment activities such as global and regional projects. Since ISARM is a UNESCO-led multi-agency effort to improve the management of transboundary aquifers, some of the groundwater governance and knowledge-sharing activities can be seen as a part of the ISARM programme. For 2016 IGRAC will continue to contribute to ISARM as a co-chair of the IAH commission on Transboundary aquifers. Planned activities include compiling and sharing a bibliography on transboundary aquifer publications, compiling an overview of recent and ongoing transboundary groundwater initiatives, setting up a webpage and possibly organising a conference on transboundary aquifers in December 2016.

[Cooperation within IHP and HWRP programmes](#)

Many of activities in this document are associated to the International Hydrologic Programme (IHP) or even conducted in cooperation with the UNESCO-IHP secretariat. IGRAC is constantly exploring opportunities to increase its cooperation with UNESCO Water Family, namely WWAP and other water centra (starting with in-house partner, UNESCO-IHP). Since 2015, IGRAC is directly contributing to the Hydrology and Water Resources Programme (HWRP) of WMO. National Secretariat of UNESCO-IHP and HWRP in the Netherlands is becoming very instrumental in broadening this involvement at the national and regional level.

3.4.3 Publications and Communications

[Publications](#)

Below a list with publications planned to be produced in 2016:

- [3rd SDG position paper](#)

After the SDGs come into effect, IGRAC will release its final position paper in the three-part series on Groundwater and the Sustainable Development Goals. This paper will focus on the role of groundwater in the final language of the SDGs. It will also look at implementation and monitoring of the goals through a groundwater lens. Once complete, all three parts of the series might be compiled and expanded upon for peer-reviewed publication.

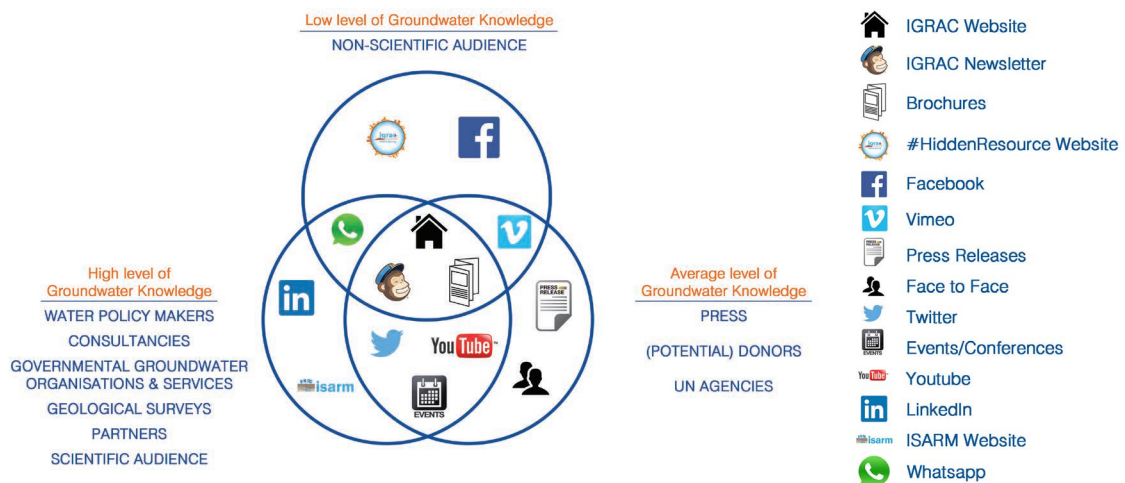
This will be the third position paper in a series, which spans the Post-2015 Sustainable Development Goals (SDG) process and is designed to discuss strategic points of intervention related to groundwater prior to the development of the draft SDGs (Position Paper No. 1); after the release of the draft and during the negotiation of goals by UN member states (Position Paper No. 2); and after the goals have come into effect, the final SDG text (Position Paper No. 3). The objective of this series is to emphasize the critical role that groundwater has in the 2030 Agenda on Sustainable Development and to ensure that relevant stakeholders make "the invisible resource" visible in their policy, planning and monitoring activities over the next 15 years.

- [Peer-reviewed article on the state of groundwater governance for Global Environmental Change](#)
This peer-reviewed article will be written by IGRAC PhD Research Fellow Kirstin Conti.
- [PhD Thesis](#)
IGRAC PhD Research Fellow Kirstin Conti will finish her PhD research in 2016. Her PhD thesis will be produced and disseminated by IGRAC as well as the University of Amsterdam
- [Transboundary Groundwater Cooperation Handbook](#)
IGRAC will contribute to the Transboundary Groundwater Cooperation Handbook, which is a UNESCO publication that will be published in 2016.
- [Groundwater Governance Book](#)
This Groundwater Governance Book, which is a joint initiative with IWMI, Biotin Foundation and Jac van der Gun, will be published in 2016. Kirstin Conti is one of the editors of this book and IGRAC will contribute by writing a chapter.
- [Water Governance in the 21st Century](#)
IGRAC's Senior Researcher Geert-Jan Nijsten and PhD Research Fellow Kirstin Conti both contributed to the book Water Governance in the 21st Century, which will be published in 2016.
- [WASH and Groundwater](#)
IGRAC is considering to recruit an intern, who could do dedicated research on groundwater in relation to WASH. This could result in a white paper for our Rotary Initiative on WASH and Groundwater.
- [Manual on Water Resources Assessment](#)
Next year, WMO will publish the 'Manual on Water Resources Assessment'. The manual is being prepared in cooperation with IGRAC and deals with both surface and groundwater resources conjunctively. The focus is mainly on water balance and water availability, while the issues of the water use, water quality and ecological needs are dealt with less detail.
- [Enabling groundwater governance: a multi-disciplinary approach for transboundary aquifers assessment at a global and local scale](#)
The scientific article 'Enabling groundwater governance: a multi-disciplinary approach for transboundary aquifers assessment at a global and local scale' will be based on IGRAC's assessment methodology for multidisciplinary assessment of transboundary aquifers in and IGRAC's Information Management System
- [Guidelines for Multidisciplinary Assessment of Transboundary Aquifers](#)
In September 2015, IGRAC developed a first draft of 'Guidelines for Multidisciplinary Assessment of Transboundary Aquifers'. This draft was launched during the IAH Congress in Rome with the objective to receive feedback from other groundwater specialists. These comments and suggestions will be integrated in the final version, which will be published in 2016.
- [GroFutures Assessment Methodology](#)
IGRAC will contribute to the GroFutures Assessment Methodology, which will be finalized in 2016.
- [TWAP in-depth Analysis](#)
TWAP data were further analyzed to assess in more detail the current condition and vulnerabilities of transboundary aquifers. IGRAC will deliver a publication aiming at further assisting potential donors to acquire a better understanding on how to localize their actions.
- [Large National Aquifers Map](#)
In 2016 IGRAC will produce a global map of large aquifers, transboundary and national. Besides new aquifer delineations, the map will include information on the groundwater development stress each aquifer is experiencing and the human dependency on each aquifer. Overlapping aquifers will be visualized in more detail.

[Communications](#)

In 2015, a two-year communication strategy was written, which forms the foundation of IGRAC's communication efforts also for 2016. One element of this strategy was defining target audiences and linking them to media and communication tools IGRAC has at its disposal.

Figure below shows an overview of media that is either used already or will be used in the near future along with the target audiences. As can be seen in this model, the IGRAC corporate website, newsletter and brochures are three media types that suit all target audiences. Additionally, there are specific media that only suit one or two target audiences. This overview assists the communication specialist when having to decide which media to use for campaigns focused on specific target groups.



- **IGRAC Website (www.un-igrac.org)** - In order to attract more visitors, it was important to develop a new website. The previous website did not have a 'responsive design' and was not suitable for mobile devices. Moreover, the content was in need of an update and restructuring. Therefore, IGRAC developed a complete new website last year. In 2016, further improvements and additional features will be implemented. One of those additions will be to make the IGRAC website a multilingual website in which the most essential information is translated in other UN languages such as French, Spanish and Russian.
- **Project websites** - As part of the website development in 2015, IGRAC was provided a feature to easily build dedicated project websites based on a template. This enables IGRAC to offer online communications as an additional service when contributing to a project. IGRAC is planning to start using this feature in 2016.
- **Social Media** - In July 2014, IGRAC started using social media as communication tool. These three social media channels have been selected, because they all attract a different audience. While followers of the IGRAC Facebook page are relatively young (65% <30) and particularly coming from developing countries, the IGRAC LinkedIn 'fanbase' mainly consists of more senior followers. Since the IGRAC Twitter is being followed by a lot of other companies, almost exclusively from developed countries, this serves a different audience than Facebook and LinkedIn. These disparities between the audiences of the various social media channels enables IGRAC to either focus on one specific target audience using one medium or reach all target audiences by integrating all channels in its communications.

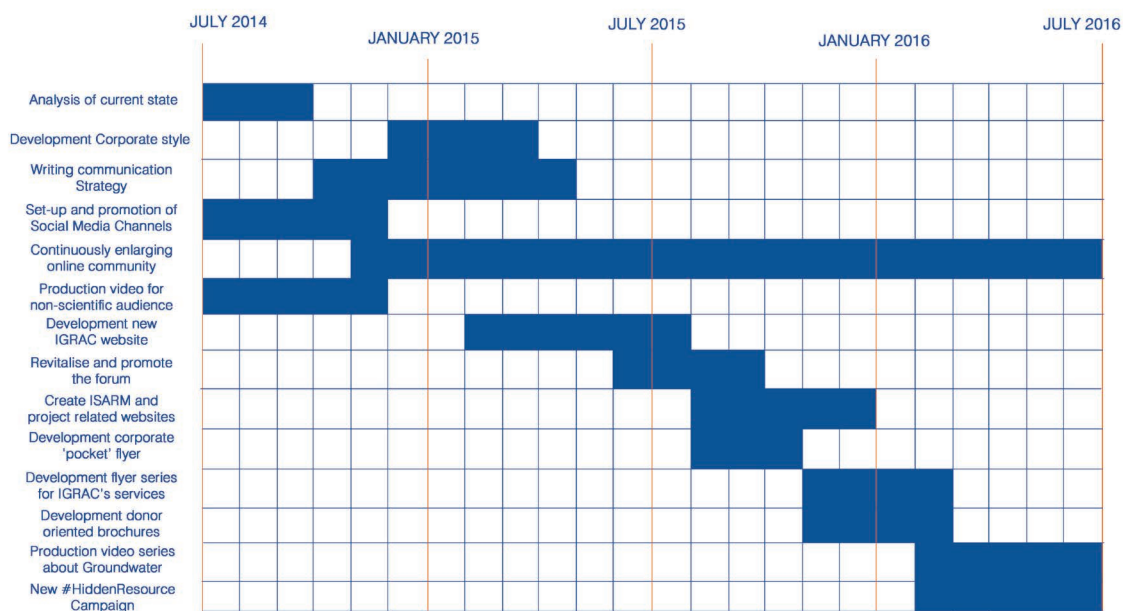
SOCIAL REACH GOALS 2016

MEDIUM	2014	2015	GOAL FOR 2016
FACEBOOK	190	13,201	20,000
TWITTER	74	743	1,500
LINKEDIN	55	175	350

The table below (source: IGRAC communication plan) shows several ongoing and planned activities to be carried out in 2016. Currently, IGRAC is developing dedicated brochures for several products and services such as the GGIS, MAR and GGMN. We aim to have these brochures finalized in the first quarter of 2016. Another major communication development is the development of a Acquisition Kit, which would contain an overview of services IGRAC can provide within projects.

The new IGRAC website contains a new section called 'What is Groundwater?', which was introduced to offer a non-scientific audience information about the groundwater basics. In 2016, IGRAC is planning to pay more attention to this target audience by expanding the 'What is Groundwater?' section on the website, but also by producing more groundwater-related videos explaining several interesting topics.

In addition, IGRAC will translate IGRAC's animated video 'Groundwater, the Hidden Resource' in order to reach more people in French, Spanish, Portuguese, Russian, Arabic and Chinese speaking countries.



3.4.4 Events

As in previous years IGRAC will take part and present as much as possible its work in relevant events. Below a selection of events is presented to which IGRAC will most likely be participating in 2016 (additionally to numerous project events):

DATE	EVENT	LOCATION
20-23 FEB	Conf. Scientific Research and Innovation for Sustainable Development in Africa	Khartoum, Sudan
20-24 JUN	ISMAR9 Conference	Mexico City, Mexico
27 AUG - 4 SEP	35th International Geological Congress	Cape Town, South Africa
25 AUG - 2 SEP	World Water Week	Stockholm, Sweden
5-7 SEP	Eurokarst 2016 Conference	Neuchatel, Switzerland
25-29 SEP	43rd IAH Congress	Montpellier, France

The meeting of the Technical Advisory Committee (TAC) could be an opportunity to organise a special event on groundwater for the participants of UNESCO-IHE and interested students of universities in the Netherlands. Since the TAC is composed of prominent international groundwater specialists, they could provide key lectures on relation between groundwater and various other fields such as irrigation, energy, economy, climate change, etc.

4. FINANCING AND OPERATIONS

The budget projection for 2016 is based on preliminary estimation of the final reserve conditions in 2015, on duration of current projects, acquisition on new ones and on available information about core funding in coming years.

The table below contains the reported IGRAC financing and operations for 2014 and the budgetary projecting for 2015 and 2016.

BUDGETARY ITEMS (IN EURO)	REPORTED	PROJECTIONS	
	2014	2015	2016
INCOMES			
Core funding	500000	500000	400000
Projects and services	257596	300000	200000
Total incomes	757596	800000	600000
EXPENCES			
Direct project costs	218806	257000	165000
Direct project costs obligation 2016*		35000	
Gross company result	538790	508000	435000
Wages and salaries	163373	180000	167000
Social security contributions	39064	42000	40000
Pensions	38425	37000	37000
Staff subcontract (advisory, PhD, interns)	37390	36000	35000
Staff costs - miscellaneous	22327	23000	23000
Total staff costs	300579	318000	302000
Software & ITC costs**	41945	75000	50000
Office rent	17688	18000	18000
Office costs	21841	23000	23000
General costs (insurance, fin. admin, etc.)	43386	42000	40000
Total company expenses	425439	476000	433000
Bank account interests and costs	9469	6000	4000
Total Results	122820	38000	6000
Software costs obligation 2016**		50000	
Previous year balance	295104	417924	405924
General reserve condition	417924	405924	411924

* The project-related software development is a part of the direct project costs. The contract (made in 2015) about the GGIS is on two years, therefore "the project costs obligation" of 35.000 € for 2016. The same amount needs to be paid (for hosting and use of the cloud services) every subsequent year if we want the GGIS to remain available.

** In 2015, IGRAC invested 100.000 € (incl. VAT) in redevelopment of the GGMN. A half of this amount will be paid after delivery of the software in 2016. Therefore "software costs obligation 2016" of 50.000 € in the overview table.

ANNEX 1: OPERATIONAL LOGICAL FRAMEWORK IGRAC FOR 2016

ACTIVITY CLUSTER	OBJECTIVES	ACTIVITIES 2015	CLIENT / BENEFICIARY	EXECUTING PARTNERS	PERSONNEL (FTE)**
GGIS (Global Groundwater Information System)	To improve availability and accessibility of data and information required for sustainable groundwater resources development and management	Redevelopment of GGMM	Involved countries, IFI, WMO	ESD, UNESCO-IHE	0.4
		Development of MAR IMS, RAMOTSWA Portal, Atlas of Africa Portal, etc.	Involved countries, IAH-MAR Consortium, GGC	ESD	0.4
Global Groundwater Assessment	To improve knowledge about global groundwater resources, with emphasis of internationally shared aquifers	Country-based assessment, country briefs and GW Atlas of Africa	Involved countries, BGS, WWAP, IFI, GGC	BGS, Involved countries, WB	0.3
		Transboundary Aquifer Assessment projects RAMOTSWA, possible GGRE-TA 2nd phase, GEF DIKTAS, SADC 2 project, ISARM Programme	GEF, Involved countries, UN-Water, SDC, IFI, GGC	UNESCO-IHP countries & regional org, IMWI	1.6
Global Groundwater Monitoring	To improve quality and accessibility of groundwater monitoring information and obtain better understanding of change of groundwater resources	Guidelines for TBAs, Managing Aquifer Recharge, SIDS GW Assessment, GW Economy	Involved countries, WWAP, GGC, IFI	UNESCO-IHP, IAH, 3R, Consortium, CBS	0.6
		Regional workshops for Small Island Developing States (SIDS) in Pacific, and in Thailand	Involved countries, WMO, GEO, IFI	Countries, WMO, regional org, IFI, Eijkelkamp NV	0.4
Knowledge Sharing and Governance	To build a trust and increase participative, transparent and informed groundwater management	Further implementation of the GGMM web services and linking with other databases (GEMS-Water)	GGC, USGS, Canadian Geological Survey, UNEP GEO, NASA	Countries, IFI, WMO	0.1
		Further embedding GGMM in WMO programme and global consortia	Involved network organisations, WMO	Countries, WMO	0.2
Total activities (estimated)		Sustainable Development Goals (SDGs) indicators, targets and monitoring	UN Member States	UNESCO-IHP, UN-WATER	0.4
		WMO Manual, Water Accounting, IW-LEARN, ISARM,	WMO, GEF, IFI	UNESCO-IHP, WMO, GEF, UNESCO-IHE	0.3
		GROFuture	UK National Research Council, Involved countries	Univ. College of London, IMWI, countries	0.3
		HOPE, FREEWAT	Involved countries & GGC	UNESCO-IHP	0.2
		Traineeship on Groundwater and Disaster Risk Management	Ministry of I&E, IFI (WB)	Ministry of I&E	0.1
		Publications and Communication	GGC, IFI, public	UNESCO-IHP	0.7
Total activities (estimated)					6
GGC = Global Groundwater Community (professionals requiring groundwater information, including the scientific community); IFI = (Inter)national Funding Institutions (World Bank, SDC, USAID, UKNRC, etc) ESD = External Software Developers					



International Groundwater Resources Assessment Centre



International Groundwater Resources Assessment Centre

Report

2014

IGRAC (International Groundwater Resources Assessment Centre) facilitates and promotes international sharing of information and knowledge required for sustainable groundwater resources development and management.

Delft,
May 2015



Government of
The Netherlands



United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme



World Meteorological
Organization

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IGRAC Report 2014

Delft, May 2015

IGRAC Report 2014

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ANNEX: THE MINUTES FROM THE GOVERNING BOARD MEETING, DEC. 2014

List of Acronyms

AGW-Net	African Groundwater Network
BGR	German Federal Institute for Geosciences and Natural Resources
BGS	British Geological Survey
CIWA	Cooperation in International Waters in Africa (World Bank trust fund)
CoP	Community of Practice
DGIS	Directorate-General for International Cooperation (Dutch Ministry of Foreign Affairs)
DIKTAS	Protection and Sustainable Use of the Dinaric Karst Aquifer System project
GCOS	Global Climate Observing System
GEF	Global Environment Facility
GGIS	Global Groundwater Information System
GGRETA	Groundwater Resources Governance in Transboundary Aquifers project, a new name for the SDC project
GGMN	Global Groundwater Monitoring Network
GTN-H	Global Terrestrial Network - Hydrology
HYCOS	Hydrological Cycle Observing System
IAH	International Association of Hydrogeologists
IFAS	International Fund for saving Aral Sea
IGAD	Intergovernmental Authority on Development
IHP	International Hydrological Programme
IMS	Information Management System
INWRMP	Inland Water Resources Management Programme
IW-LEARN	International Waters Learning Exchange and Resource Network
ISARM	Internationally Shared Aquifer Resources Management
IWMI	International Water Management Institute
MAR	Managed Aquifer Recharge
MIM	Meta Information Module (a GGIS component)
OGC	Open Geospatial Consortium
SADC	Southern African Development Community
SAP	Strategic Action Plan
SDC	Swiss Agency for Development and Cooperation, in the past also used to indicate the SDC funded GGRETA project
SIDS	Small Island Developing States
TWAP	Transboundary Water Assessment Programme
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
WB	World Bank
WHYCOS	World Hydrological Cycle Observing System
WHYMAP	World-wide Hydrogeological Mapping and Assessment Programme
WMO	World Meteorological Organisation
WPP	Water Partnership Programme

1. Summary

This document reports on IGRAC's activities in 2014. The activities were conducted according to the Work Plan 2014 and the Strategic Document 2012-2017.

Transboundary aquifer assessment remained the main IGRAC activity, executed in three long-term UNESCO projects. Since the contracting procedure with UNESCO speeded up to some extent, additional staff members were recruited in order to fulfil the contracting obligations and conduct other planned activities. This had an immediate effect of reducing work pressure and increasing motivation and productivity. Eventually, 2014 was a very productive and financially positive year.

Development of a new version of GGIS (Global groundwater Information System) was challenging also due to new software developers; in meantime first new GGIS modules became operational.

One of the characteristics of 2014 was certainly broad thematic assessment. Due to engagement of several interns, IGRAC was able to conduct assessment of a several global groundwater issues, including ecosystem-based adaptation in groundwater management, the groundwater-food-energy nexus and economics in groundwater governance.

Groundwater monitoring remained one of the main tasks of IGRAC; without knowing the current state and the trend of groundwater resources, no proper management measures can be taken. Implementation of the Global Groundwater Monitoring Network (GGMN) programme continued with a major introductory workshop in China.

A large number of groundwater governance and knowledge sharing activities took place in 2014, resulting in numerous publications, presentations and events. In 2014 IGRAC started promoting its activities on Twitter, Facebook and LinkedIn and with clear success. The campaign about 'Groundwater: The Hidden Resource' showed that making information on groundwater available through media is a necessary complementary activity to IGRAC content activities.

2. Organisational/Institutional Activities

In 2014, IGRAC continued the activities aimed at further strengthening the Centre's organisational structure as well as its links with various institutions and programmes.

In January 2014, an IGRAC presentation and a number of meetings were organised at the World Bank. Particularly a project Sustainable Groundwater Management in SADC Member States was discussed. Based on IGRAC's proven record with project implementation, the World Bank was assured that IGRAC can substantially contribute to this important project (12M USD); however an appropriate modality for involvement needed to be found. IGRAC could join a consortium of consultants but then the centre would be seen as a commercial party and not as a non-profit, independent UN centre, trusted by countries with their groundwater data. The other option to engage IGRAC would be for the bank to make a procurement agreement with UNESCO. Unfortunately, there was no support for this option from the UNESCO administration since IGRAC is not legally a part of UNESCO. The programmes supported by the Netherlands were also addressed with the World Bank staff, especially the Water Partnership Programme (WPP) and the Cooperation in International Waters in Africa (CIWA) programme. Again, IGRAC involvement outside of a regular tender procedure would probably

be possible only through the UN or when requested by recipient countries (the latter would probably be the option for the SADC project).

Cooperation between the World Bank and IGRAC continued throughout the year, exploring possibilities for common activities in the regions of Eastern Africa and Central Asia. On the longer term, it seems that the World Bank would be ready to support an international centre/institute with a relevant expertise. The best, and only possibly only, way to achieve that would be to build up a proven record in World Bank projects. The Dutch delegation at the World Bank is supportive of more water-related projects with involvement of expertise from the Netherlands. However, similar support would be required from the Government of the Netherlands when prioritising issues and related expertise.

UNESCO has a crucial role in the current IGRAC project portfolio. IGRAC's main activities are the projects executed through UNESCO, namely DIKTAS, TWAP and GGRETA. IGRAC does not have the status and impact of UNESCO to independently attract funding organisations such as Global Environment Facility (DIKTAS, TWAP) or Swiss Development Cooperation (GGRETA). Nevertheless, IGRAC is a UNESCO and WMO centre and that helps IGRAC to enter project consortia such as UPGRO and HELP (see the chapter 4). However, acquisition and execution of projects could be substantially improved if the status of category II centra at UNESCO were more precisely defined.

In accordance with the consensus of the last Governing Board meeting, IGRAC initiated increased cooperation with WMO. IGRAC is active in a number of WMO related networks (e.g. GTN-H and GCOS/TOPC) but not in WMO programmes like WHYCOS and IGAD-HYCOS. Hopefully, with a new WMO representative on the IGRAC Governing Board, new opportunities for cooperation will be created.

Regarding the internal organisational structure, required enlargement of the IGRAC Foundation Board is accomplished, now consisting of representatives from UNESCO-IHE, Deltares and Technical University Delft. Nevertheless, the current composition does not have to be definite; IGRAC will continue an active search for other knowledge organisations in the Netherlands potentially interested in joining the Foundation Board. In its August 2014 meeting, the Foundation Board discussed the performance of the IGRAC foundation and advised on several procedural and financial issues (e.g. a yearly report needs to be reviewed by the Founding Board before sending it to the Governing Board).

Contribution of the Netherlands to international groundwater programmes and projects was discussed in order to locate possibilities for IGRAC involvement. It is very difficult for IGRAC to become engaged in the Water OS programme of the Ministry of Foreign Affairs, Directorate-General for International Cooperation (DGIS) because of the procedures. The procedures for involvement in international programmes supported by the Netherlands, such as the WPP and CIWA are not favourable either. These are World Bank programmes and executed according to the World Bank procedures. Groundwater is included in these programmes but it is not a priority for the DGIS when it comes to the programme execution; the attention clearly goes to the other water sectors: flooding, sea water intrusion, sanitation, etc.

IGRAC intended to hold a meeting of the Technical Advisory Committee (TAC) during the IAH Congress in Morocco (September 2014) but only three members attended the congress. Organising a TAC meeting does not have a priority and is costly, having the members in various continents. IGRAC Strategy Document 2012-2017 was discussed with most of the TAC members individually, yielding useful contributions. Nevertheless, the TAC is a part of the envisaged IGRAC organisational structure and should have a face-to-face meeting planned for next year in Delft.

IAH Executive Board requested to nominate a member to the IGRAC TAC. A vice-president and two past presidents of IAH are already members of the TAC (but selected by the Governing Board on individual basis as prominent peers). Further,

IGRAC suggested becoming an observer to the IAH Council in order to enhance information flow in both directions. IGRAC is an IAH corporate member and has excellent cooperation with many IAH commissions (e.g. Karst, MAR, Climate Change). For a newly established Commission on Transboundary Aquifers, IGRAC has provided one of the co-chairs.

The main organisational novelty with respect to personnel and ways of working at IGRAC in 2014 was engagement of interns. In total five young professionals received their first practical working experience at IGRAC in 2014. The benefits for both interns and IGRAC were obvious; nevertheless, guiding of interns is time-consuming and not more than two interns at the time should be at IGRAC with the current personnel capacity. At the moment IGRAC has seven staff members, including one PhD researcher. IGRAC aims to increase the number to around ten staff members in coming years.

3. Content Activities

IGRAC's content activities in 2014 were for the most part a follow up of activities in previous year, conducted in accordance with the Work Plan 2014 and the IGRAC Strategic Planning 2012-2017. IGRAC activities were also influenced by various external factors but there was no significant deviation from the yearly planning. This year, thematic groundwater assessments and knowledge sharing activities were more diverse and extensive than in previous years. The main activity structure remained practically the same as last year:

- Global Groundwater Information System
- Global Groundwater Assessment
- Global Groundwater Monitoring Network
- Knowledge Sharing Groundwater Governance

Next chapter contains an overview of the main activities and their outcomes. Additional information is available in project documents and other IGRAC products and services, as referenced in the overview below.

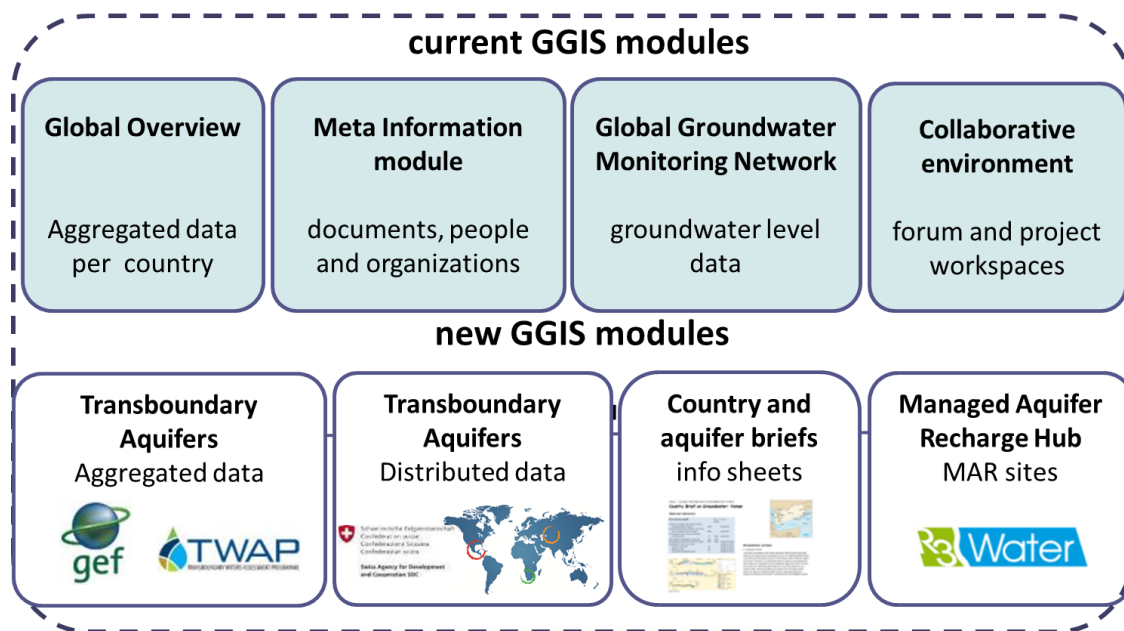
3.1 Global Groundwater Information System (GGIS)

GGIS is IGRAC's web-portal to groundwater-related information and knowledge. It leads the user from available, aggregated global information, via related information sources, towards a direct information exchange. The software developed for monitoring (the GGMN application) and other IGRAC online databases are also considered a part of the GGIS.

3.1.1 Software update

In 2014, IGRAC completely redeveloped and expanded the GGIS using open and extendable state of the art technology, making it possible to connect to more varied external data sources and systems on the internet. The system has been expanded by two project based modules (TWAP and GGRETA) designed to manage and view both aggregated and distributed information on transboundary aquifers.

The user interface has been upgraded following specific requirements for usable data types, general layout, GIS tools and web mapping services. All modules are built in the same environment to create consistency among user interfaces and possibilities to combine data from the various projects. The accessibility, performance and user friendliness of the refurbished GGIS have been improved while allowing for more interactive participation of its users.



Updates and changes of Global Overview

The global overview provides a general review of the groundwater conditions per country in an interactive map. It enables comparisons of groundwater characteristics between countries and searches for global patterns. The Global Overview module has been redeveloped, including contemporary GIS user interface functionalities, as well as improved functionalities to find and combine information.

The Meta Information Module

The Meta Information Module (MIM) contains groundwater related documents, reference documents, and information on groundwater specialists and organizations. The MIM has been redeveloped and includes improved search functionalities, as well as advancements in upload, storage and download of various types of documents. The MIM has been extended by a user account management system where IGRAC administrators can arrange the access rights to the GIS users. As such, content updates in the renewed GIS can increasingly be carried out directly by the GIS user community and, depending on their access rights, allow GIS users to work in protected workspaces within the GIS for sharing and exchanging information.

Development of a TWAP Groundwater Information System

An information management system has been developed to upload and store the information collected in the groundwater component of the Transboundary Waters Assessment Programme (TWAP). The TWAP-Groundwater component is the first global baseline assessment of transboundary aquifers and includes the assessment of the 242 largest transboundary aquifers in the world and the aquifers of 43 small island developing states. The TWAP viewer contains aggregated data, variables and indicators, encompassing the hydrogeological, environmental, socio-economical and governance dimensions of the aquifer systems. This viewer enables users to make a global comparison and to discover data/information gaps.

Development of GGRETA Information System

The Groundwater Resources Governance in Transboundary Aquifers Project (GGRETA) information system provides detailed information on three transboundary aquifers. The project conducts in-depth assessment of three transboundary aquifers located in: Southern Africa, Central Asia, and Central America. The portal is developed to collect, store, visualise and share information in order to support transboundary groundwater governance. The system allows upload of various types of data, and the possibility to create overlays of data. Unlike TWAP, GGRETA does not deliver only aggregated data, but also spatially distributed information (maps).

WMS functionalities

The system is created in such a way that it allows to easily adding data from external sources using OGC web services. At the same time, data within the system can be easily shared with other groundwater systems or experts. It thereby makes use of the web mapping services (WMS) to distribute maps and web feature services (WFS) to distribute data.

Country briefs and transboundary aquifer briefs

The briefs are created within the GIS system in order to disseminate descriptions of aquifer or groundwater resources in a country in a structured but narrative way. The system automatically generates the brief extracting pieces of information from the various modules, while additional images and text can be added per brief.

Explore all modules

An additional viewer has been created to explore all available groundwater-related data on countries, transboundary aquifers and groundwater monitoring networks at once. The data from the various projects are combined in this viewer.

3.1.2 Content update

The main content update of GIS in 2014 consisted of the following:

Transboundary Waters Assessment Programme (TWAP)

Large amount of data was been collected/ estimated for all transboundary aquifers (approximately 250) larger than 5000 km² and 43 groundwater systems on Small Island Developing States (SIDS). The data are collected/ estimated at the aquifer level. For more information see on the TWAP project description further on in the report.

Groundwater Governance in Transboundary Aquifers (SDC/GGRETA) project

The collection of spatially distributed data (such as shape files, geo-tiff and point data) in the three selected projects is an ongoing process. The first data has been added to the system. For more information see GGRETA project.

Transboundary and Country Aquifer Briefs

The first aquifer country briefs (Netherlands, Yemen, Botswana) have been added to the system. The output of transboundary aquifer briefs for the TWAP project started in 2014.

3.2 Global Groundwater Assessment

Groundwater assessment activities at IGRAC encompass country-based assessments, transboundary groundwater assessments and thematic assessments.

3.2.1 Global Country-based Assessment

In 2014, IGRAC continued development of country briefs. The briefs are a standardised overview of the groundwater situation by country presented in a narrative way. They are less 'technical' in comparison to the data in the GGIS and thus more appealing for general public. The main indicators and additional information on the groundwater conditions in the respective countries/aquifer are described. The briefs will also contain interpreted data linking the various attributes stored in the GGIS. In 2014, the framework for the development and a structure of the information was created, as well as outputs for a several country briefs.

3.2.2 Transboundary Aquifer Assessment

Transboundary Aquifer Assessment remained the main IGRAC activity in 2014. Commissioned by UNESCO-IHP, IGRAC concentrated its activities on three large projects: TWAP, DIKTAS and SDC. Additionally, Transboundary Aquifers of the World Map was updated. A brief description of main activities 2014 is given below.

Transboundary Water Assessment Programme (TWAP)

Recognizing the importance of transboundary water systems to humans and ecosystems; the fact that many of the water systems continue to be degraded; and that most are managed in fragmented ways, the Global Environment Facility initiated the Transboundary Water Assessment Programme (GEF TWAP) (www.geftwap.org).



IGRAC was previously involved in the TWAP medium-sized project (2009-2011) in which the methodology for an indicator based assessment was developed. In 2013 the TWAP full-sized project started. This two-year programme is the first global comparative assessment of five transboundary water system categories: groundwater, lakes, rivers, large marine ecosystems and open oceans. The assessment of each water system category is undertaken in five individual sub-projects (also called components) and the assessments are multi-disciplinary covering the hydro(geo)logical, socio-economical, environmental, legal and institutional aspects of the water systems. The envisaged outcome is to provide the GEF and other international organizations with tools and information for setting priorities in activities related to sustainable management of transboundary water systems. The assessment is executed through institutional partnerships aiming to also seed future follow-up assessments. The TWAP groundwater component (www.twap.isarm.org) is assessing 242 transboundary aquifers and 43 groundwater systems of Small Island Developing States (SIDS). Data have been collected through networks of regional and national experts. The project is executed by UNESCO-IHP in close cooperation with IGRAC.

The project started in April 2013 and will conclude in April 2015. Total budget for the project is about 36,8M USD (5M USD GEF grant, 13.1M USD co-financing and 18.7M USD in-kind). The budget for the TWAP Groundwater component is 12.6M USD and IGRAC's planned involvement is approximately 1M USD - partly funded by the GEF & co-financing and partly by in-kind contributions).

IGRAC's main responsibilities are in coordinating the global data collection process, setting up the TWAP-groundwater information management system (TWAP IMS), providing technical assistance to all parties and together with UNESCO-IHP taking care of the over-all project management. Like in 2013 TWAP activities in 2014 have been numerous and intensive:

- Together with UNESCO-IHP, IGRAC forms the project management team for the TWAP Groundwater component. As such IGRAC is involved in all aspects of the project's organisation. Activities include establishing the network of regional and national experts, coordinating activities of these experts, reporting to UNEP (implementing agency for the GEF), etc. In the first quarter of 2014 there were personnel changes in UNESCO-IHP and IGRAC took over project management in the interim.
- Together with UNESCO-IHP, IGRAC represents the Groundwater component in the TWAP steering committee meetings. In 2014, remote meetings have been conducted using skype and conference calls.
- Participation in the cross-cutting working groups (with the other water systems) on Governance and Data & Information Management.
- Coordinating technical harmonisation with Frankfurt University for global groundwater modelling component and Simon Frasier University Canada for SIDS-groundwater assessment.
- IGRAC co-organised and presented at regional workshops for national experts:
 - o The regional workshop for Southern and Eastern Africa (Kenya - March 2014)
 - o The regional workshop for West and Central Africa (Senegal - July 2014)
 - o The regional workshop for Central, East, South and South-east Asia (Thailand-October 2014).
- IGRAC organised and guided the process of data collection through questionnaires (526 questionnaires have been sent out to 116 countries); provided technical support to regional coordinators and national experts; coordinated improving delineations of TBAs and digitising of maps; processed returned questionnaires including uploading of information into

- TWAP database and performing basic quality checks, calculation of indicators based on input from questionnaires, etc.
- IGRAC developed, tested and implemented of a pilot version of the web-based Information Management System (IMS) for the TWAP Groundwater component enabling future public access to all data collected in TWAP (maps, documents and graphics). The TWAP IMS is developed as a module of the fully upgraded and redesigned GGIS.
 - IGRAC contributed to the draft component synthesis report, which combines and summarises the findings of the assessment of 242 transboundary aquifers, 43 SIDS groundwater systems and the results from the scenario studies through modelling.
 - IGRAC conducted project communication including design, set-up and maintenance of webpage and workspace for the TWAP Groundwater component

The detailed TWAP Project Report for 2014 is prepared and available from IGRAC or UNESCO on request.

Protection and Sustainable Use of the Dinaric Karst Aquifer System (DIKTAS)

DIKTAS (<http://diktas.iwlearn.org>) has started in 2010 and it is the first GEF project executed by UNESCO. IGRAC provides project management and also contributes to various content activities. The total project budget is about 5.6M USD, wherefrom about 2.1M USD of the funding is from the GEF and 3.4M USD is in-kind co-financing by project partners. IGRAC's total contribution to the project is about 1M USD, wherefrom approximately 40% is funded by GEF and 60% is in-kind.

The Transboundary Diagnostic Analysis (TDA) has been finalized in December 2013 and adopted by the Steering Committee in June 2014. The TDA report is delivered with a total delay of about 12 months, comparing with the original the planning in the Project Document. The main reasons for the delay were a complexity of the analysis and the numerous comments of stakeholders that needed to be discussed and processed. The TDA went through a very systematic reviewing process, being discussed by National Interministerial Committees (NICs) twice. The draft TDA report was already submitted to the Steering Committee in June 2013, but dozens of comments received from National interministerial Committees needed to be discussed, processed and included in the report. The report is quite comprehensive and well supported by the DIKTAS Database. At the time of writing (October 2014) the report awaits translation in five local languages.



Delay in delivering the TDA has also slowed down the work on SAP, Strategic Action Plan, but not substantially. At the Project Team meeting in Trebinje in March 2014, the content of the SAP report was discussed and writing tasks were assigned. The project manager compiled the first draft, distributed it to the SAP Writing Team, incorporated comments and prepared a final draft. The draft DIKTAS SAP awaits translation to be discussed by NICs in the meeting planned for Autumn 2014. Next to the conference, the SAP was the main activity in the first half of 2014 and will remain the main activity until the end of the project.

The DIKTAS Conference "Karst without Boundaries" was held in Trebinje, Bosnia and Herzegovina and Dubrovnik, Croatia in June 2014. The conference was organized in the framework of the DIKTAS project in partnership with the International Association of Hydrogeologists (IAH), in collaboration with the Hydropower System Trebišnjica (HET), Trebinje, Bosnia & Herzegovina and the University of Belgrade, Serbia and with support of UNESCO, IGRAC, and GWP-Med. The conference brought together 155 international karst scientists, engineers and DIKTAS stakeholders from 35 countries and was a huge success. The positive reactions were overwhelming. It was a major effort to organise the conference, that slowed down some other project activities but it was certainly worthwhile because it returned attention of international scientific community to this region after many years.



The detailed DIKTAS Project Report for 2014 (reviewed and approved by the DIKTAS Steering Committee) is available on request.

Groundwater Resources Governance in Transboundary Aquifers (SDC project)

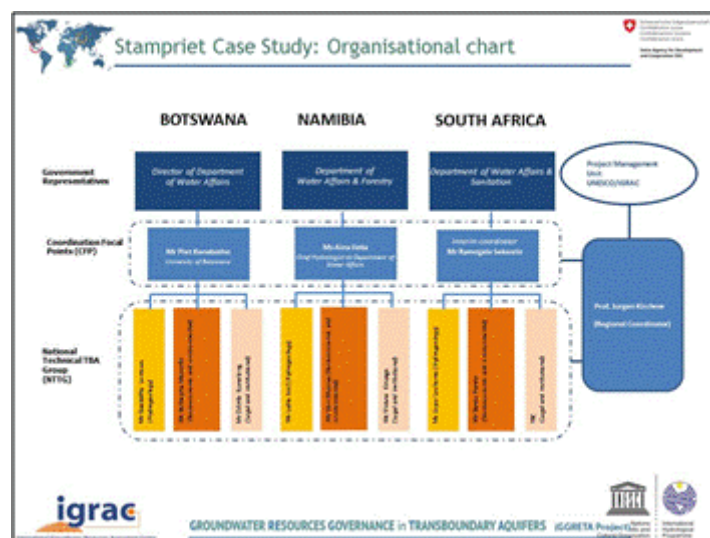
Phase I of the project "Groundwater Resources Governance in Transboundary Aquifers" started in April 2013. The project, which will run until December 2015, is funded by the Swiss Agency for Development and Cooperation (SDC) with a total budget of approximately 1,9M€ plus co-financing. It is executed by UNESCO-IHP with IGRAC as a major partner. The objectives of the project are:

- to improve the knowledge and recognition of the importance and vulnerability of transboundary groundwater resources;
- to establish cross-border dialogue and cooperation;
- to develop shared management tools;
- and to facilitate governance reforms focused on improving livelihoods, economic development and environmental sustainability.

The focus in Phase 1 of the project is on the joint assessment of the selected transboundary aquifers and to lay the first foundation for joint management. Three transboundary aquifers have been selected for the project: the Trifinio Aquifer between El Salvador, Honduras, and Guatemala; the Stampriet Aquifer between Botswana, Namibia, and South Africa; and the Pretashkent Aquifer between Kazakhstan and Uzbekistan.

IGRAC is responsible for data and information management and also provides technical support to the project management and transboundary aquifer teams. The main IGRAC activities in 2014 were:

- Developing a methodology brief and extensive methodology guidelines for the assessment, based on the TWAP methodology. The methodology brief informs managers of the project design, while the guidelines serve as a manual for the experts in the national teams to execute the data collection, processing and the final assessment.
- Developing, testing and implementing a pilot version of the web-based Information Management System (IMS) for the GGRETA project, enabling future public access to the final outputs (maps, tables, graphs, documents, etc.) produced in the three GGRETA case studies. The GGRETA IMS is developed as a module of the fully upgraded and redesigned IGRAC GIS.
- Conducting a Stampriet Regional technical seminar (three days, Namibia - May 2014) to introduce the three national teams to the project's design, planning and methodology and to initiate joint data collection on hydrogeological, socioeconomic, environmental, legal and institutional aspects.
- Conducting the 3rd Stampriet Regional Technical Meeting (three days, South Africa - October 2014) to report to the three national governments and the donor representatives on project progress in terms of data collection and processing of hydrogeological, socioeconomic and environmental and legal and institutional data. To assist and guide the teams of national experts in data harmonisation and processing.
- The Esquipulas-Ocotepaque-Citalá aquifer (Trifinio aquifer) made slow but constant progress in 2014, where consultants were engaged by IUCN to start the collection of existing data and identification of main data gaps and information needs. IGRAC keeps regular contact with IUCN and the consultants via teleconference, providing technical support and guidance.
- For the Kazakh part of the Pretashkent aquifer, most available data have been collected and interpreted in 2014. The project team still awaits a clearance from the Government of Uzbekistan to proceed with comparable activities in the Uzbek part of the Pretashkent aquifer.
- Providing project management support by contributing to documents such as Terms of Reference, project summaries, agendas for workshops and project planning, etc.



Transboundary Aquifers of the World Map

IGRAC published a new Transboundary Aquifers of the World Map (TBA Map) in August 2014. The TBA Map 2014 shows 608 identified transboundary aquifers, including 226 transboundary 'groundwater bodies' as defined in the European Union Water Framework Directive (EU WFD). The map is an update of the TBA Map 2012 and shows the state of information presently available on the occurrence and extent of transboundary aquifers worldwide. The map provides a global overview of these important shared water resources and intends to encourage further research and assessment thereof. The map is based on the most recent inventory results of many active working groups around the world (including the TWAP project). This map aims to contribute to raising awareness on the importance of the governance of shared aquifer resources and to building the much needed global knowledge base. Full details on the methodology creating this map as well as definitions and additional information such as on the legend are given on its backside. The map has already been distributed at various meetings/conferences such as IAH Marrakech, TWAP regional workshops, UNECE workshop on transboundary basins, etc.

3.2.3 Thematic Assessment

In the IGRAC thematic assessment, a global groundwater issue (such as a methodology or a pollution type) is chosen and assessed globally in more detail. In 2014, IGRAC carried out various thematic assessments, including studies on ecosystem-based adaptation in groundwater management, the groundwater-food-energy nexus, economics in groundwater governance and a global assessment of nitrate contamination.

Ecosystem-based Adaptation in Groundwater Management

IGRAC carried out a thematic assessment on ecosystem based adaptation in groundwater management. The report provides an overview of various ecosystem-based adaptation measures related to groundwater that could be implemented to improve ecosystems resilience and secure the ecosystem services. The report was part of the preparation phase for the project 'Ecosystem-based Adaptation in Groundwater Management' a joint effort of UNEP, IGRAC, IWMI and UNESCO-IHP.

In May 2014, IGRAC attended the ecohydrology workshop and steering committee meeting in Paris, France. The meeting served as a start-up of the eighth phase of the UNESCO-IHP. The objectives of the meeting were to reactivate the Ecohydrology programme within UNESCO-IHP, seek partnerships and synergies to implement projects and to plan the activities within the Ecohydrology Theme 5 of the new IHP Phase 8.



The Groundwater-Food-Energy nexus

In 2014, IGRAC also started a thematic assessment on the role of groundwater in the water-food-energy water-food-energy nexus. The water-food-energy nexus elucidates the crucial links among the water, food and energy sectors and the importance of governance and management across sectors and scales to improve and secure water, food and energy resources. The report provides an overview of the role of groundwater in the water-food-energy nexus and is supported by two concrete examples in India and in Spain.

Groundwater Economics

Increasing pressures on groundwater and subsequent economic scarcities augment the importance of sustainable resource management. Knowledge about the economic value of water in its different uses can help to support allocation decisions, emphasize the importance of the resource itself, and consequently create a sound basis for negotiations. For this reason IGRAC started reviewing the current state of the art in groundwater valuation and deriving a theoretical framework. This framework was subsequently applied to the Stampriet and DIKTAS aquifers since they are both part of important projects within IGRAC. It was found that there are still frictions between disciplines when it comes to the integration of economic results into water governance. However, economic valuation might be a feasible way to consider all economic impacts of a project or policy by bringing them to a comparable basis. Nevertheless, additional data are necessary for any well-grounded conclusion.

Global Nitrate Assessment

Nitrate pollution is considered a major agricultural pressure on groundwater resources. In October 2014, IGRAC began to investigate groundwater pollution with nitrate in transboundary aquifers and to identify best management practices and future challenges. Reviewing, collecting and analysing available information produced an overview of large transboundary aquifers prone to nitrate pollution. Data was presented in GIS maps. To explore and stimulate possible future collaboration with University of Wageningen (UW), IGRAC deployed an MSc student from UW for this project.

Managed Aquifer Recharge (MAR)

In November 2014, IGRAC and Acacia Water started a consultancy project for the design and development of data systems for the application of Management for Aquifer Recharge (MAR) in the Horn of Africa. The project has been awarded by IGAD-INWRMP (Inland Water Resources Management Programme) to IGRAC and subcontractor Acacia Water. The project will cover a time period of three months.

The overall emphasis of the project is to identify and map the potential for different MAR applications within the transboundary Merti Aquifer, shared between Kenya and Somalia, and the development of a MAR data management system. In addition a conceptualized model is developed which couples climate scenarios to land surface characteristics, to test the impact on the runoff, recharge and MAR systems in the selected aquifer and its recharge area. One of the objectives of the study will be to show the potential of critical groundwater zones for current and future water supply, and the potential of MAR to strengthen this resource. The study will lead to a GIS data system showing potential MAR sites and results will be presented in a final report.

3.3 Global Groundwater Monitoring

Global Groundwater Monitoring Network (GGMN) is a participative, web-based network of networks, set up to improve quality and accessibility of groundwater monitoring information and subsequently our knowledge on the state of groundwater resources. GGMN is a UNESCO programme, implemented by IGRAC and supported by many global and regional partners.

IGRAC, UNESCO-IHE, Deltares and Royal Eijkelpark joined forces to facilitate and promote advanced groundwater monitoring technology and innovative practices in China. On 17-19 March 2014, the workshop Advancing Groundwater Monitoring in China was held in Beijing, China. The workshop was organised in the framework of the Global Groundwater Monitoring Network (GGMN) programme and in close cooperation with Geological Survey of China. The

purpose of the workshop was to bring together national and international groundwater experts to review the state of groundwater monitoring in China and set future goals. In total, 46 groundwater experts attended the workshop. The Global Groundwater Monitoring Network (GGMN) programme was introduced and its relevance to groundwater monitoring in China was discussed. The workshop addressed new monitoring technologies, groundwater monitoring optimisation and other related aspects of monitoring networks. The workshop was also intended to build synergies and strengthen international cooperation.



A workshop Collation and Analysis of Multi-decadal Groundwater-levels Observations in Africa was held at the IAH Congress in Marrakech, Morocco to support the analysis of groundwater-level data by workshop participants. IGRAC contributed to the workshop introducing GGMN Programme. The workshop conclusion was to use the GGMN portal application as the groundwater portal for the so-called Chronicles Consortium to store the multi-decadal records of groundwater levels in Africa. The Chronicles of Africa is a joint initiative of the AGW-Net, IAH Commission on Groundwater and Climate Change, and UNESCO-IHP GRAPHIC programme that is supported by the UPGro programme of the UK government and the LMI-PICASSEAU programme of the French government.

IGRAC contributed to the 16th session of the GCOS/TOPC Panel at the Joint Research Centre in Ispra, Italy. GCOS is a joint undertaking of the WMO, the Intergovernmental Oceanographic Commission of UNESCO, UNEP and the International Council for Science. Its goal is to provide comprehensive information on the total climate system where groundwater makes one of the essential climatic variables. IGRAC is responsible for the groundwater observations and it has contributed to the report 'Climate Observing Systems in the Netherlands, National Activities Contributing to GCOS'.

3.4 Knowledge Sharing and Governance

Knowledge sharing is a part of all IGRAC activities and involves creating networks of people and development of services for these networks. Some activities listed below can also be seen as thematic developments but they do not necessarily include assessment. These activities are dedicated to knowledge sharing (and governance) beyond the usual management structure, including public participation. In the chapter below, distinction is made between activities (mostly

project-based) and dissemination and outreach through publications, social media, events, etc.

3.4.1 Governance

Groundwater Governance - A Global Framework for Action (2011-2014) is a joint project supported by the GEF and implemented by the FAO, UNESCO-IHP, IAH and the World Bank. The project is designed to raise awareness about the importance of groundwater resources for many regions of the world, and identify and promote best practices in groundwater governance as a way to achieve the sustainable management of groundwater resources. IGRAC has been involved throughout the project by co-authoring the thematic paper 'Groundwater Policy and Governance' and actively contributing to four regional consultations world-wide. In 2013 IGRAC was a part of the organising and hosting team for the 5th and last Regional Consultation for UNECE Region combined with a Private Sector Roundtable in The Hague in March 2013 (approx. 100 international participants). As a follow up of the consultation, IGRAC contributed to the reporting of sessions.

Groundwater Futures in Sub-Saharan Africa (GroFutures)

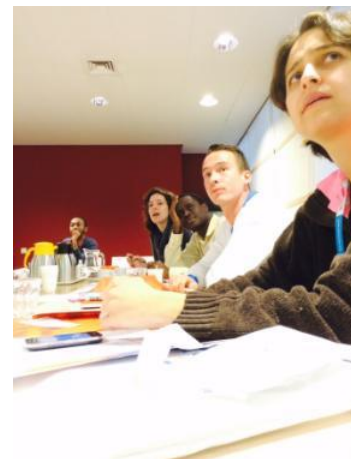
GroFutures - Groundwater Futures in Sub-Saharan Africa - is a project lead by Prof. Richard Taylor from the University College of London, in which IGRAC is involved. The project aims to develop the scientific basis and participatory processes by which groundwater resources can be used sustainably for poverty alleviation in Sub-Saharan Africa (SSA).

During 2014, IGRAC has been involved in the design of the project proposal. The design phase took in place under a one-year Catalyst grant from UPGro programme funded by the UK's Government. The objective of this preparation phase was to set up the scientific framework and network of the project, and design the proposal presented for the Consortium Grant. During this preparation phase, IGRAC attended the Consortium Proposal Development Workshop in London and contributed to the preparation of the Consortium Grant preparation, which was approved in early 2015.

Groundwater Serious Game

As a contribution to the GroFutures project, IGRAC is improving the Groundwater Serious Game, developed by Frank van Weert and based on Garrett Hardin's theory and article 'The Tragedy of the Commons' (1968). The game will be used in the project as an awareness rising tool between stakeholders. It will help them to understand the dilemmas faced by small-scale farmers seeking effective and equitable ways to manage their groundwater resources individually and collectively to irrigate their land.

Currently the game has been modified to improve some basic aspects that will help model the reality of the groundwater management problem at household scale. The game still presents the core idea of 'The Tragedy of the Groundwater Commons', but it includes two more ideas, the importance of information availability and accessibility and the concept of long term depletion. The first concept is being implemented by the addition of development scenarios, through which the user has to take decisions based on different levels of data availability. On the other hand, the concept of long term groundwater depletion implies the adaptation of the original code, computing the drawdown.



Quantifying the benefits of transboundary water cooperation

In 2014, IGRAC provided a written contribution for the UNECE's draft report on quantifying the benefits of transboundary water cooperation. The contribution highlighted the current state-of-the-art in benefit assessment for groundwater and transboundary aquifers. It also recommended starting points for countries wanting to undertake such an assessment. IGRAC also participated in a UNECE hosted event, wherein examples and best practices were gathered from countries all over the globe. The final scoping meeting for the report is scheduled for early 2015. IGRAC may further enhance its contribution with the outcomes of the study of groundwater economics.

3.4.2 Knowledge Sharing and People Networks

Groundwater Community of Practice

In 2014, activities for the Groundwater Community of Practice (Groundwater CoP) continued primarily through face-to-face interaction. The third and final IW:LEARN Integration Dialogue took place in Athens. It brought together experts on coastal aquifers and groundwater in Small Island Developing States (SIDS) from all over the world. It was also an official event for the 2014 International Year of the SIDS. The purpose of these meetings was to facilitate enhanced dialogues between GEF groundwater and surface water projects for enhanced sustainability of results. Although this phase of the IW: Learn Project is drawing to a close, the Groundwater CoP will continue its dialogues in the Forum. The Forum will continue hosting webinars of groundwater relevant topics. In 2015, there is a planned re-launching of the Forum which will include a new look as well as enhanced facilities that will facilitate participation in the CoP webinars and other online events. Additionally, a new phase of IW LEARN is anticipated. Therefore, online and face-to-face activities will continue with an emphasis on knowledge sharing via online platforms.

Hydro Open-source Platform of Experts (HOPE)

The UNESCO's Hydro Open-source Platform of Experts (HOPE) is a platform of experts that aims to provide an alternative to the commercial specialized engineering software in the field of hydrology (e.g. water resources, rivers and groundwater, etc.). In 2014, IGRAC participated in the Consultative Experts Working Group to finalise the evaluation form for the selection of Groundwater-related software and Data Management and Support software. In parallel, the working group worked on the evaluation of several water related software, publishing the first HOPE Kit.

FREE and Open Source Software for Water Resources Management (FREEWAT)

FREEWAT aims at promoting water management and planning by simplifying the application of the EU Water Framework Directive and other EU water-related Directives. FREEWAT will be an open source and public domain GIS integrated modelling environment for the simulation of water quantity and quality in surface water and groundwater with an integrated water management and planning module. The Consortium is formed with partners from various water sectors from ten EU countries, Turkey and Ukraine. It will be executed under the support and collaboration of the UNESCO HOPE Initiative on Free and Open Source Software.

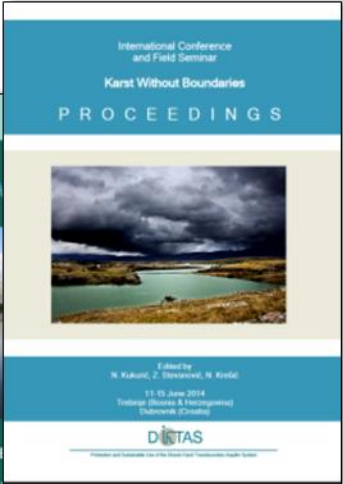
IGRAC together with UNESCO's HOPE Initiative prepared a case study for the Stampriet aquifer as a contribution to the project proposal. The case study will help test the application, while providing training on groundwater related software to National Experts working in the Botswana, Namibia and South Africa.



Currently the project proposal has been awarded with a Horizon2020 fund that will allow its execution starting the 1st of April of 2015 for duration of 30 months.

3.4.3 Publications and communications

Books and book chapters

- "Karst Without Boundaries" Proceedings International Conference and Field Seminar, Editors N. Kukuric et al, 431p, Trebinje June 2014. The DIKTAS Conference "Karst without Boundaries" was held in Trebinje, Bosnia and Herzegovina and Dubrovnik, Croatia in June 2014. There were 155 participants from 35 countries and five continents attended the conference which was organised around following topics: Aquifer Characterization and Monitoring, Aquifer Management and Legal Framework, Water Resources Engineering, Groundwater Sustainable Use, Protection and Remediation, and Awareness, Education and Outreach. The conference proceedings include 106 contributions on karst hydrogeology written by about 300 authors.
- 
- "Field Trip Guide", Editors P Milanović et al, DIKTAS Project/ Faculty of Mining and Geology, Department for Hydrogeology, 69p. Trebinje/Belgrade 2014. Four field trips were organised during the DIKTAS conference (June 2014). This guide provides extensive information on the field trip routes and places to be visited. The guide was also used for the Summer Karst School, which was held back-to-back with the conference, and can be used in the future for the same purpose. The guide is the result of cooperation between the DIKTAS Project Team and the University of Belgrade and its Centre for Karst Hydrogeology.
 - "Groundwater Security", K. Conti et al., is a contribution to the upcoming Global Water System's Project book on water security. This is the first research focused on groundwater security and discusses the physical and human dimensions of groundwater security at each geographic level. This includes how groundwater storage and flow patterns relate to security as well as how abstraction and global change dynamics may affect these patterns. It also discusses the human dimension of groundwater security including human uses and impacts of quality on those uses. Further, it presents the specific physical and human groundwater security challenges occurring at each geographical level: global, transboundary/regional, national and subnational. It finds that there are threats to groundwater security in specific transboundary aquifers and countries, but that these do not necessarily amount to a threat to global groundwater security as of yet.

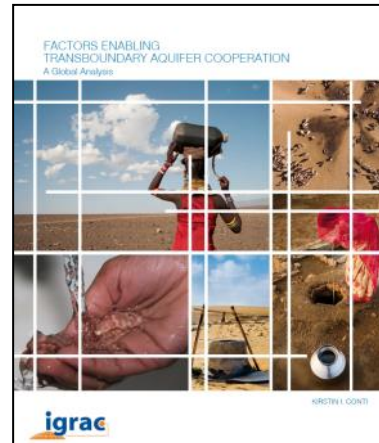
Papers

- "Legal Pluralism and Groundwater" K Conti; in the Current Opinion in Environmental Sustainability Journal. The paper highlighted incongruences among developing groundwater governance regimes at the global,

transboundary and national levels. The research showed that when legal regimes for groundwater governance are in place, it is unlikely that they are aligned across geographic scales and jurisdictions. Therefore, legal pluralism with respect to groundwater resources is more the rule than the exception. Yet, the literature so far had not compared how emerging governance principles relate to existing principles at local level. Examples from the Americas, Europe, South Asia and Sub-Saharan Africa, were presented to show the varying relationship between new rules and old, both coexisting over the same aquifer may affect the governance of groundwater.

Reports

- Factors Enabling Transboundary Aquifer Cooperation (IGRAC 2014). In this assessment, twenty cases of transboundary aquifer cooperation were identified and assessed. Based on this assessment, which was grounded by established and emerging concepts of water conflict and cooperation, IGRAC found that eight key factors lead to transboundary groundwater cooperation: Existing Regional Institutions, Funding Mechanisms, High Institutional Capacity, Previous Water Cooperation, Scientific Research, Strong Political Will, Third-party Involvement. The preliminary findings of this assessment were presented in 2013 Free Flow (the UNESCO Book for the Year of Water Cooperation) and presented at Stockholm World Water Week 2013. In 2014, they were published in full in as an IGRAC Report.
- Groundwater Monitoring in Latin America: Overview on the current state of national monitoring networks and their future challenges (IGRAC Publication, 2014).
- Position Paper No. 1 on the Sustainable Development Goals (IGRAC 2014)
- Ecosystem based adaptation for groundwater Management (IGRAC, UNEP, IMWI, 2014).
- The Groundwater Food Energy Nexus, An Integrated Approach for Sustainable Groundwater Development (IGRAC, 2014).
- Significance and State of Affairs of Groundwater Economics in the Governance of Transboundary Aquifers (IGRAC, 2014).



Abstracts and Presentations

- The DIKTAS conference Karst without Boundaries: DIKTAS, A Rocky Road to Cooperation; keynote speech. 2014.
- Conti, K. and Gupta, J. (2014). "Legal Pluralism and Groundwater: A Multilevel Analysis of Legal Institutions Applicable to Groundwater", presented at Responsible Development in a Polycentric World: Inequality, Citizenship and the Middle Classes hosted by the European Association of Development Research and Training Institutes (EADI), Bonn, Germany, June 26, 2014.
- Conti, K. and Gupta, J. (2014). "Drivers of Global Groundwater Use: Consequences for Access, Allocation and Availability", presented at the Norwich Conference on Earth Systems Governance, Norwich, UK, July 1, 2014
- Global Groundwater Information System 2.0, IAH Congress, Morocco (2014); The presentation showed the progress of the software developments for IGRAC's Global Groundwater Information System (GGIS) 2.0 and explained how the accessibility, performance and user friendliness of the refurbished GGIS will be improved.

- Transboundary Waters Assessment Programme, IAH Congress, Morocco (2014); The presentation was about a potential of the TWAP information system and the importance of assimilating the data into indicators. The TWAP indicators will allow comparison between transboundary aquifers globally, representing the first global assessment of transboundary aquifers.
- Global Groundwater Monitoring Network, IAH Congress, Morocco (2014); The presentation "Groundwater Monitoring: Building Blocks for International Water Cooperation" gave an overview of the Global Groundwater Monitoring Network (GGMN), which facilitates periodic assessments of changes in groundwater quantity and quality by aggregating data and information from existing groundwater monitoring networks and regional hydrogeological knowledge.

Public Relations and Social Media

Increasing visibility of IGRAC activities was one of the objectives for 2014; therefore a communication specialist was contracted in July 2014. Hiring the specialist resulted in more frequent updates of the website. For example, in the specialist's first three months, sixteen news items were published. This was already more than has been published in 2013 over an entire year. Consequently, from July 2014 onwards the number of IGRAC website page views increased significantly.

Until mid-2014, IGRAC was not using social media for communication purposes. There was a company page on LinkedIn, although not actively used; however, there were no Facebook or Twitter accounts. Since then, every news item placed on the IGRAC was also shared on LinkedIn. In addition, these items were posted on several LinkedIn groups related to the topic in order to reach a larger audience and to increase the number of IGRAC followers. Although IGRAC usage of LinkedIn and social media in general is still in an initial phase, each IGRAC's post was viewed by 200-300 people on average. This tripled a number of followers on LinkedIn.

IGRAC has received 185 likes on Facebook since it has opened its account in July 2014 and has 53 Twitter followers moment. This is good progress considering that even for large NGO's it took much time before their number of followers grew substantially. Considering that the IGRAC Twitter account was only created in July 2014, it is very likely that the number of followers will grow in the near future. The new and improved newsletter has been sent out bimonthly to our 1,936 subscribers.



IGRAC at IAH Congress

IAH International Congress will be held in Marrakech, Morocco

From 15 to 19 September 2014, the IAH International Congress will be held in Marrakech, Morocco. The main theme of this 41st edition of the congress will be 'Groundwater: Challenges and Strategies'. Neno Kukuric and Laura del Val Alonso will lead several sessions during this events. More information about these sessions and a link to the full programme are now available on our website.

[Read more here](#)

3.4.4 Events

This brief overview includes only the events that were not a part of IGRAC content activities described in the chapter 3.2 and 3.3.

- International Association of Hydrogeologists (IAH) organised its 41st Congress in September 2014. The venue of this IAH Congress annual event was Marrakech, Morocco. IGRAC contributed to the congress with three abstracts and several presentations, also during the side- event on groundwater monitoring.

- On invitation of the Government of Uzbekistan, an IGRAC representative attended the International conference "Development of cooperation in the Aral Sea Basin to mitigate consequences of the environmental catastrophe". IGRAC was provided an opportunity to meet with water ministers of several Central Asian countries and to give interviews for national and international newspapers and TV stations.



- IGRAC participated in the 5th UNECE workshop on climate change adaptation in transboundary basins (October 2014, Geneva). IGRAC was invited to present on Managed Aquifer Recharge and Ecosystem based adaptation as a climate change adaptation measure during this workshop.
- Groundwater and Climate Change: Comparative and International Law and Policy Dimensions - Lessons for India, Workshop; IGRAC was able to contribute its knowledge on transboundary aquifers and aquifer assessment as well as legal issues to the discussion, London, January 2014.
- First Coordination Meeting of the project "Integrated and Sustainable Management of Shared Aquifer Systems and Basins of the Sahel Region", IGRAC represented UNESCO, May 2014 Vienna, Austria.

4. Budgeting

The state of IGRAC's budgetary affairs at the end of 2014 is summarised in the table below. There is a Financial Statement Report (in Dutch, 26p) produced by an external bureau for the IGRAC Foundation Board and it is available on request.

Budgetary items (amounts in Euro)	
	Calendar year 2014
INCOMES	
Base subsidy	500000
Projects and Services*	257596
Total incomes	757596
EXPENSES	
Direct project costs	236777
Gross company result	538790
Wages and salaries	163373
Social security contributions	39064
Pensions	38425
Staff subcontracted (advisory, PhD, interns)	37390
Staff costs - miscellaneous	22327
<i>Total staff costs</i>	<i>300579</i>
Software development costs	41945
Office rent	17688
Office costs	21841
General costs (insurance, fin. admin, etc.)	43386
Total company expenses	425439
Bank account interests and costs	9469
Result 2014	122820
Previous year balance	295104
General reserve condition	417924

Annex: The Minutes from the Governing Board meeting, Dec. 2014

ANNEX: THE MINUTES FROM THE GOVERNING BOARD MEETING, DEC. 2014

The Minutes

from the fourth meeting of the

Governing Board

Held in Delft on 12th December 2014

Present:

Ms. Elaine Alwayn, the chair of the Board
Ms. Alice Aureli, a member of the Board
Mr. Julius Wellens-Mensah, a member of the Board

Mr. Neno Kukurić, secretary of the Board
Mr. Niels Vlaanderen, assistant to the chair of the Board

Absent:

Mr. Joop de Schutter, a member of the Board

The chair Ms Alwayn opened the meeting at 9.30, welcomed the participants and in particular a new member of the Board, Mr Julius Wellens-Mensah, representative of WMO to the Board. Mr Wellens-Mensah, who then briefly introduced himself, is the chief of Basic Systems in Hydrology Division, Climate and Water Department at WMO. Mr Wellens-Mensah stressed that he is pleased to be member of the Board and eager to contribute to its work.

Subsequently, Ms Alwayn asked for adoption of the proposed agenda. The agenda was adopted without further remarks:

Adopted Agenda

Agenda

- 9.30 - 9.45: Welcome, adopting the agenda
- 9.45 - 10.00: Adoption of previously sent documents:
 - Governing Board Minutes of the Meeting 2013
 - IGRAC Report 2013
- 10.00 - 10.30: IGRAC State of Affairs (2014)
- 10.30 - 11.00: IGRAC Work Plan 2015
- 11.00 - 11.30: Discussion on State of Affairs & Work Plan
- 11.30 - 12.00: Future of the Centre (2016-2020)
- 12.00 - 12.15: Conclusions and agreements
- 12.15 - 12.30: Any other business
- 12.30: Closing the meeting

Adoption of previously sent documents

Subsequently the Governing Board adopted the Minutes of its meeting from December 2013 and the IGRAC Report 2013. Both documents had been previously sent to the Governing Board and the received comments were processed.

Ms Alwayn asked about suggestion of Mr Grabs (from the last Governing Board meeting) to prepare a communication strategy in order to increase its visibility. Mr Kukurić replied that IGRAC employed a communication specialist last summer and that a communication plan is under preparation.

IGRAC State of Affairs and Work Plan 2015

Requested by Ms Alwayn, Mr Kukurić presented the State of the Affairs 2013 and the Work Plan for 2014. (The presentation is available via the IGRAC portal and for the Governing Board members also on the new IGRAC memory stick that they received).

Firstly a video clip 'Groundwater: The Hidden Resource' has been shown. Mainly thanks to the support of several United Nations organisations, the video had a large social reach (over 7 million people) and IGRAC received plenty of enthusiastic reactions (among others from the Minister for Infrastructure and the Environment of the Netherlands). The members of the Governing Board found video very appropriate for public campaign on groundwater and complimented IGRAC on this product.

In continuation, Mr Kukurić presented the state of the affairs and the work plan for 2015 regarding institutional activities, content activities and financing. During the presentation, several questions were posed by the members of the Governing Board, especially about the institutional positioning of IGRAC. IGRAC relationship with the World Bank is of paramount importance but an appropriate modality needs to be found to allow IGRAC engagement in the World Bank projects. IGRAC cannot act as a commercial enterprise because of its status as an independent and non-profit UN centre, trusted by countries with their groundwater data. Mr Kukurić stressed that this could be avoided if UNESCO would entrust IGRAC to act on behalf of UNESCO and use the existing procurement agreement protocol between UNESCO and World Bank.

Mr Kukurić recalled that recently The Netherlands and the World Bank signed a Memorandum of Understanding about a newly-founded Water Global Practice fund of the Bank. Accordingly, The Netherlands will have a permanent position in the fund and more impact on borrowing and related projects. The Netherlands is already contributing to various WB programmes such as Water Partnership Programme (WPP) and the Cooperation in International Waters in Africa (CIWA) programme. Possibilities for IGRAC's involvement in these and coming projects also depends of priorities set by the Ministry of Foreign Affairs Directorate-General for International Cooperation (DGIS). Groundwater is often included in programmes but it is not a priority for DGIS; other water sectors such as floods, sea water intrusion, sanitation, etc. are receiving much more attention. IGRAC needs to use its network more effectively to bring groundwater higher on the priority list at DGIS. Mr Kukurić is assured that members of the IGRAC Governing Board and the Foundation Board can substantially contribute to this endeavour.

Mr Kukurić presented new project ideas, initiatives and leads. 2014 showed that IGRAC is able of acquiring projects on its own. However, IGRAC obviously does not have the status and impact of UNESCO to independently attract major funding institutions and donors. Therefore, UNESCO will continue to play a crucial role for the IGRAC project portfolio, as stipulated in the IGRAC foundation agreement. Mr Kukurić noted that the common acquisition and project

execution with UNESCO would be substantially improved by further clarifying the status of category II centres at UNESCO.

IGRAC would like to invest in further developing cooperation with the World Meteorological Organisation. The centre is active in a number of WMO related networks but not in the WMO projects.

In 2015 IGRAC intends to round off development of the major Global Groundwater Information System (GGIS) components. Software development is challenging but there is a constant progress. Once ready, the GGIS will be the most complete repository of groundwater-related information globally.

The three main transboundary assessment projects will be completed in 2015 and together with UNESCO, IGRAC is working to secure continuation of existing projects and acquisition of new ones. The experience in aquifer assessment gained in last several years together with the GGIS applications make IGRAC an attractive partner for various kinds of regional groundwater assessment and studies.

IGRAC will continue to expand its knowledge base with contemporary aspects and/or tools required for informed groundwater resources management. Groundwater economics, serious gaming, groundwater-food-energy nexus and ecosystem based adaptation are some of topics that will receive special attention.

Groundwater monitoring remains one of the main tasks of IGRAC; without knowing the current state and the trend of groundwater resources, no proper management measures can be taken.

Finally Mr Kukurić presented the budget projection for 2015, based on preliminary estimation of the final reserve conditions in 2014 and on IGRAC's ambitions in the coming years. While presenting the estimated budget, Mr Kukurić stressed his appreciation about collaboration with UNESCO-IHP (the most of the IGRAC project assignments are coming from UNESCO-IHP). There are still some administrative issues (such as contracting/transfer of project funds) that should be resolved, being inherent to the status of UNESCO category 2 centres. Mr Kukurić stressed that presented budget projection is quite conservative; a slight change of the IGRAC administrative status at UNESCO and/or an effective use of the IGRAC network at the Ministry of Foreign Affairs can bring substantial budgetary advancements.

Future of the centre

Ms Alwayn pointed out that the work IGRAC carried out in the last year is very impressive. The chair reflected on the history of IGRAC in terms of financial support from the Government of the Netherlands. From 2003 until 2010, IGRAC was funded from the Partners for Water Programme, 1M€ p/y. In 2011, as a part of the agreement with UNESCO, the Government committed to co-fund IGRAC for the period of five years, 0.5M€ p/y. Ms Alwayn stressed that the excellent performance and large impact of IGRAC motivated the Ministry of Infrastructure and the Environment to search for continuation of the co-funding for the period 2016-2020. At this moment, however, it seems that not more than 0.3M€ p/y can be made available from the Ministry.

Ms Alwayn informed the Governing Board that the Ministry of Infrastructure and the Environment and the Ministry of Foreign Affairs are working towards closer cooperation on international waters. Since recently, Ms Alwayn is responsible for both bilateral and multilateral international water cooperation portfolio at the Ministry of Infrastructure and the Environment and coordinates related cooperation with the Ministry of Foreign Affairs. Ms Alwayn will present the work of IGRAC at the joint meeting with the Ministry of Foreign Affairs and advocate for an additional funding. The chair will inform the Governing Board about the co-financing of IGRAC for the period 2016-2020 before April 1st 2015.

Mr Kukurić expressed his appreciation for the effort of the Ministry to support the continuation of the centre. IGRAC will gladly prepare any additional material possibly required for the presentation of the centre to the Ministry of Foreign Affairs. Mr Kukurić stressed the importance of keeping co-financing at the current level for the continued existence of the centre. In that case, the agreement between UNESCO and The Kingdom of the Netherlands (as ratified by the Parliament of the Netherlands and the General Conference of UNESCO) needs neither discussion nor adjustments and it will be renewed by tacit agreement. Ms Alwayn commented that Mr Kukurić should be more optimistic about the prospects of the centre.

Mr Wellens-Mensah emphasized the importance of United Nation centres like IGRAC, not only for a hosting country but for the global community. He recalled that Germany is hosting several centres, including the Global Runoff Data Centre, the Global Precipitation Climatology Centre and since recently GEMS-Water. Groundwater is not particularly addressed in the WMO activities although it is one of the essential climate variables. The main chance of involving IGRAC in the project activities would be through the Inland Water Resources Management Programme (INWRMP) as IGRAC is already doing (by winning a tender in the IGAD region). Furthermore, IGRAC can contribute to the Manual on Water Resources Assessment whose development is coordinated by WMO.

Mr Wellens-Mensah reflected on initiative of IGRAC to visit Secretary General of WMO at the beginning of 2014. He believes that this visit should take place in 2015 and suggested to IGRAC to write again to WMO. As initially suggested, the IGRAC director would be accompanied by the representative of the Ministry Infrastructure and the Environment.

Finally, Mr Wellens-Mensah noted that a visibility of IGRAC within the United Nations needs to be increased and particularly in the communication with member states.

Mr Aureli supported the view of Mr Wellens-Mensah about IGRAC's visibility. She suggested preparing a common UNESCO-WMO statement on groundwater and IGRAC for the annual WMO congress. Mr Aureli stressed that a statement with the same message should be prepared for other events such as meetings of UN Africa and AMCOW (African Ministers' Council on Water).

Ms Aureli recalled that IGRAC is working very closely with the UNESCO IHP Secretariat, mostly through execution of projects financed by national and international donor agencies. These projects are very challenging but the cooperation is very fruitful. According to Ms Aureli IGRAC is increasingly gaining a status of globally recognised centre. International financial institutions and donors are prepared to work with IGRAC more intensively, asking for a long-term commitment of the centre. Therefore, the IGRAC founding partners need to provide more clarity about the future of the centre.

Ms Aureli supported the suggestion of an IGRAC visit to WMO and suggested a similar visit to UNESCO's new Assistant Director General (ADG) for Natural Sciences.

Any other business

IGRAC will be present at the 7th World Water Forum in Korea in April 2015. IGRAC will share the booth with UNESCO-IHP and UNESCO-IHE. IGRAC is preparing a special addition of the map Transboundary Aquifers of the World and some additional PR material. There is still not much clarity about possibilities for an IGRAC contribution to various sessions. UNESCO IHP is coordinating a number of groundwater issues and will involve IGRAC where needed.

Mr Vlaanderen informed the Governing Board that the Government of the Netherlands is preparing a contribution on Sustainable Development Goals together with the World Water Council. A possible contribution of IGRAC can be suggested to involved parties.

Mr Vlaanderen also informed the Governing Board that the Government of the Netherlands is preparing new activities with the World Bank where involvement of IGRAC can be taken in consideration.

N Kukurić informed the Governing Board that Mr de Schutter was unable to attend the meeting due to a mission abroad. Mr de Schutter is retiring from UNESCO-IHE, hence UNESCO-IHE will nominate a new representative to the Governing Board. In order to keep the information flow optimal, a suggestion is that Mr de Schutter remain attending the Governing Board meetings in capacity of the chair of the IGRAC Foundation Board.

Conclusions and agreements

- The Minutes Governing Board meeting 2013 are adopted;
- The IGRAC Report 2013 is adopted;
- IGRAC will approach WMO (Secretary General) and UNESCO (ADG Natural Sciences) requesting the visits to these organisations, not later than April 1st 2015;
- The Ministry will inform the Governing Board (not later than April 1st 2015) about co-financing of IGRAC centre in the period 2016-2020;
- The Ministry will take an action to place a trainee at IGRAC, not later than April 1st 2015;
- UNESCO and WMO will prepare a common statement on groundwater/IGRAC and do necessary steps to include the statement in various events (such as UN General Assembly, WMO Congress, AMCOW meeting, etc.).
- The Ministry will check possibilities to involve IGRAC in the WWF- and WB- related activities.

Closing the meeting

Meeting of the Governing Board was closed by the chair Ms. Alwayn at 12.35.



International Groundwater Resources Assessment Centre



International Groundwater Resources Assessment Centre

ANNUAL REPORT

2015



United Nations
Educational, Scientific and
Cultural Organization



International
Hydrological
Programme



IGRAC Report 2015

Delft, March 2015



IGRAC (International Groundwater Resources Assessment Centre) facilitates and promotes international sharing of information and knowledge required for sustainable groundwater resources development and management worldwide. Since 2003, IGRAC provides independent content and process support, focusing particularly on transboundary aquifer assessment and groundwater monitoring.

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ANNEX: Minutes from the Governing Board meeting, Dec. 2015

LIST OF ACRONYMS

BGR	German Federal Institute for Geosciences and Natural Resources
BGS	British Geological Survey
DGIS	Directorate-General for International Cooperation (Dutch Ministry of Foreign Affairs)
DIKTAS	Protection and Sustainable Use of the Dinaric Karst Aquifer System project
EU WFD	European Union Water Framework Directive
FAO	Food and Agriculture Organization
FREEWAT	Free and open source software for water resources management
GCOS	Global Climate Observing System
GEF	Global Environment Facility
GEMI	Global Environmental Monitoring Initiative
GGIS	Global Groundwater Information System
GGRETA	Groundwater Resources Governance in Transboundary Aquifers project, a new name for the SDC project
GGMN	Global Groundwater Monitoring Network
GTN-H	Global Terrestrial Network - Hydrology
HYCOS	Hydrological Cycle Observing System
IAH	International Association of Hydrogeologists
IGAD	Intergovernmental Authority on Development
IHP	International Hydrological Programme
IMS	Information Management System
INWRMP	Inland Water Resources Management Programme
ISARM	Internationally Shared Aquifer Resources Management
IWA	International Water Ambitions (new cooperation mechanism among three ministries in the Netherlands)
IWMI	International Water Management Institute
MAR	Managed Aquifer Recharge
MIM	Meta Information Module (a GGIS component)
NASA	National Aeronautics and Space Administration
OGC	Open Geospatial Consortium
PCU	Project Coordination Unit
RESILIM	Resilience in the Limpopo Basin Program
RWSN	Rural Water Supply Network
SADC	Southern African Development Community
SAP	Strategic Action Plan
SDC	Swiss Agency for Development and Cooperation, in the past also used to indicate the SDC funded GGRETA project
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
TAC	Technical Advisory Committee
TBA	Transboundary Aquifer
TDA	Transboundary Diagnostic Analysis
TWAP	Transboundary Water Assessment Programme
UN-Habitat	United Nations Human Settlements Programme
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
UpGro	Unlocking Groundwater's Potential for the Poor Programme
USAID	United States Agency for International Development
USGS	United States Geological Survey
WHYMAP	World-wide Hydrogeological Mapping and Assessment Programme
WHO	World Health Organization
WMO	World Meteorological Organization
WRI	Water Resources Institute

1. SUMMARY

This is a report of IGRAC's activities in 2015, which were conducted in line with 'Work Plan 2015' and 'Strategic Document 2012-2017.'

In 2015, most time and effort was invested in transboundary aquifer (TBA) assessment activities as planned; although the rounding off and the closure of three long-term TBA assessment projects took longer than expected. Almost half of IGRAC's time in 2015 was dedicated to TBA related activities, including development of Guidelines for Interdisciplinary TBA Assessment and various TBA software modules in the Global Groundwater Information System (GGIS).

The GGIS was completely renewed in 2015, with exception of a groundwater motoring portal that is still under development. Development of contemporary software applications with cloud-based services is a challenging but rewarding undertaking: the new GGIS makes sharing, on-line processing and reuse of groundwater information easier and more beneficial for the user. Finally, the GGIS can be easily extended with new portals such as the one developed for Managing Aquifer Recharge.

Implementation of the Global Groundwater Monitoring Network (GGMN) programme continued, including a development of new GGMN portal. We began organizing two regional workshops with key partners and began preparation this year, although they will be executed in the course of 2016.

In 2015, IGRAC provided ongoing contributions to the development of indicators for Sustainable Development Goals (SDG) in the framework of the 2030 Agenda for Sustainable Development. This report also briefly describes IGRAC's participation in various other groundwater related projects, initiatives, webinars, conferences, etc. We also developed new websites (for us and our partners), produced a number of publications and substantially expanded our networks through the social media.

IGRAC had the largest turnover in 12 year of its existence. Despite good performance and good financial situation, there was no increase in staff due to high uncertainty about funding of the centre after 2015. Towards the end of the year, the Government of the Netherlands and United Nations Educational, Scientific and Cultural Organization (UNESCO) formally expressed their intention to renew the IGRAC Agreement and the Government of the Netherlands confirmed its intention to continue providing the core-financing to the centre. This together has made 2015 a very good year for IGRAC.



Fig 1. TBA Assessment Guidelines

2. ORGANISATIONAL / INSTITUTIONAL ACTIVITIES

2.1 INSTITUTIONAL ACTIVITIES

In 2015, IGRAC continued efforts to further strengthen the Centre's organisational structure as well as its links with various other institutes and international programmes. UNESCO's International Hydrological Programme (UNESCO-IHP) remained to be IGRAC's main partner, in particular through engagement of IGRAC in execution of UNESCO-IHP-led externally funded projects: DIKTAS, TWAP and GGRETA. UNESCO-IHP is IGRAC's natural partner as IGRAC's mission and objectives are closely related to UNESCO-IHP objectives and projects. Both IGRAC and UNESCO-IHP made considerable efforts to develop the most optimal working relationship. The main obstacle is still the rather ambivalent position of UNESCO category II centres like IGRAC: The UNESCO Water Division and the UNESCO-IHP Secretariat would like to see IGRAC as an integral part of UNESCO, while the UNESCO administration deals with IGRAC in the same way as with any other external partner. This ambivalent position leads to complications in interpretations of agreements and contracts, different expectations and consequently reduced effectiveness of common activities. These issues have been discussed in the 2015 Governing Board meeting. The renewal of the agreement on IGRAC between UNESCO and the Netherlands in 2016 is a logical moment to review this situation.

IGRAC strives to get engaged in World Bank activities. In January 2014, IGRAC was introduced at the World Bank and since that time, together with groundwater specialists at the World Bank, we have been searching for a modality to get engaged in various World Bank activities/projects. A promising opportunity for IGRAC involvement is the Bank's project Sustainable Groundwater Management in Southern African Development Community (SADC) Member States but the formal start of the project has been delayed considerably which means no activities have yet been undertaken. In 2015, The Netherlands and the World Bank signed a Memorandum of Understanding about a newly-founded Water Global Practice fund. In meetings between the Bank and the Netherlands to define priority water issues for these funds to be allocated to, the relevance of groundwater has been highlighted, as well as the role of IGRAC as an important associated institute.

In August 2015, IGRAC hosted a meeting with representatives from the World Bank, the Directorate-General for International Cooperation (DGIS) of the Netherlands Ministry of Foreign Affairs and groundwater specialists from the Netherlands.



Fig 2. World Bank roundtable

Opportunities for IGRAC's involvement in World Bank projects depend also on priorities set by the Ministry of Foreign Affairs Directorate-General for International Cooperation. Groundwater is often included in programmes but it is not a priority for DGIS. The new cooperation mechanism among three ministries in the Netherlands on the International Water Ambitions (IWA) can be promising for groundwater and IGRAC. On request of the Ministry for Infrastructure and Environment, IGRAC has provided suggestions on IGRAC's potential contributions to the International Water Ambitions programme. Also, IGRAC involvement in monitoring of Sustainable Development Goals (SDGs) could be of interest to the Government of the Netherlands, especially as the Netherlands has become one of the 'water related SDG proof of concept countries'.

In October 2015, IGRAC was invited to the World Bank for a meeting to exchange ideas on groundwater in the Bank's lending activities. The event was organised by Water Global Practice and five organisations were involved, including USGS (United States Geological Survey) and NASA (National Aeronautics and Space Administration). One of the outcomes of the meeting is

that IGRAC will be involved if the Bank decides to develop a country-based groundwater assessment approach.

IGRAC substantially increased contacts and cooperation with the World Meteorological Organization (WMO), as was agreed in the 2014 Governing Board meeting. IGRAC is now involved in the preparation of the WMO Manual on Water Resources Assessment. In May 2015, IGRAC visited WMO and discussed possibilities for cooperation with Mr Jarraud, WMO Secretary-General. Among others, it was agreed that IGRAC could provide training on groundwater monitoring in the framework of the Hydrological Cycle Observing System (HYCOS) and GGMN programmes, with the first training currently being organised for representatives of the Small Island Developing States (SIDS) in the Pacific region.

In 2015, IGRAC contributed substantially to the congress of the International Association of Hydrogeologists (IAH) in Rome. IGRAC also provides one of the co-chairs to the IAH commission on Transboundary Aquifers. No further steps were made towards closer institutional cooperation with the IAH Council (IGRAC is awaiting reply of the IAH Executive office on IGRAC's proposals).

IGRAC was invited to become a formal partner in the UNESCO led World-wide Hydrogeological Mapping and Assessment Programme (WHYMAP) consortium. This might also lead to closer cooperation with the German Federal Institute for Geosciences and Natural Resources (BGR) as an important international partner.

In 2015, IGRAC intensified contacts with the International Water Management Institute (IWMI) and the Water Resources Institute (WRI) in order to explore opportunities to establish institutional links. IWMI and WRI were chosen as they are international organisations that are, like IGRAC, financially supported by the Netherlands and that work on issues which are closely related to IGRAC's work. At present, the contacts with IWMI are very promising; IWMI is preparing a new strategic plan and it has consulted IGRAC about a possible strategic partnership. IWMI also invited IGRAC as a partner in the United States Agency for International Development (USAID) funded RAMOTSWA project (Botswana and South Africa), because of IGRAC's experience in the region and in setting up groundwater information management systems. In 2015 IGRAC took the initiative to join forces with IWMI to submit Expressions of Interest for two major projects for ZAMCOM together with ANTEA and UNESCO-IHE.

IGRAC held the regular Foundation Board meeting in April 2015. In this meeting the director of IGRAC reported on the (primarily financial) management of the IGRAC foundation, which was thoroughly discussed and subsequently approved by the board. Current and potential links between IGRAC and the Netherlands groundwater sector were discussed as well.

The anticipated meeting of the Technical Advisory Committee (TAC) was not held because of several reasons, among others the uncertainty about the future of the centre after 2015. IGRAC has a Strategic Plan 2012-2017. A new Strategic Plan may be prepared for the new financing cycle, probably with a renewed TAC membership.

In 2015 there has been no increase in staff, even if the financial situation may have allowed it. Despite good performance one of the temporary contracts was not renewed and the other three contracts have been renewed for a limited period only. The reason for this is that there was much uncertainty about funding of the centre after 2015. At the end of 2015, IGRAC employed seven staff members (3 with permanent contracts and 4 with temporary contracts), including one PhD researcher. In accordance with the 2012-2017 Strategic Plan, IGRAC still aims to increase this number to around ten staff members in coming years.

2.2 PROJECT ACQUISITION ACTIVITIES

In 2015 the IGRAC team intensified its project acquisition activities. Tender websites were consulted on a weekly basis to identify project funding opportunities. IGRAC responded to several calls for proposals. The table below gives an overview of the most relevant project acquisition activities in 2015.

Overview of major project acquisition activities in 2015

Fund / Client	Programme / Project	Study location	Partners	Status March 2016
Adaptation Fund	Groundwater resources in the Greater Mekong Sub region; collaborative resource management to increase resilience	Cambodia, Lao PDR, Myanmar, Thailand, Vietnam	UNESCO, IWMI, Country agencies, CCOP	Proposal declined
Angola Instituto Nacional de Recursos Hidricos	Sustainable development of the Cuvelai-Etосha transboundary aquifer (Angola and Namibia).	Angola (and possibly Namibia)	Deltares	Project idea on hold
GEF / UNDP	Determining parameters of the aquifer underlying Mt. Kilimanjaro for sustainable development and management, factoring in effects of climate change	Kenya, Tanzania	UNESCO	Project identification phase
GEF / UNDP / ANBO	Strengthening the institutional capacity of African Network of Basin Organization (ANBO), contributing to the improved transboundary water governance in Africa	Africa (ANBO /AMCOW)	UNESCO	Proposal submitted
GEF / UNEP	Improving IWRM, knowledge-based management and governance of the Niger Basin and the Iullemeden-Taoudeni/Tanezrouft Aquifer System (ITTAS)	Algeria, Bénin, Burkina Faso, Mali, Mauritania, Niger and Nigeria	UNESCO	Proposal submitted
Horizon-2020 (EU)	Preserving and improving quality and availability of groundwater in complex and changing environments	Mediterranean countries	Mediterranean countries	1 st phase proposal declined
IGAD	Transboundary Aquifer Assessment in the (Intergovernmental Authority on Development) IGAD Region	IGAD region	IGAD, Ministry of Water Kenya	Project idea submitted
Kenya - Water Resources Management Authority	Hydrogeological study in Kenya – Mandera County	Kenya	Acacia Water, Earth Water Ltd	Proposal submitted
USAID	Sustainable Water Management in the Limpopo Basin - Transboundary Ramotswa Aquifer Project	Botswana, South Africa	IWMI, XRI-geosciences solutions	Contract phase 1 awarded Phase 2 in preparation
USDA	Project component 'Pakistan Groundwater Data management' of the Pakistan Water Dialogue	Pakistan	IWMI	Proposal declined
WMO	Advancing Groundwater Monitoring in Small Island Developing States in the Pacific	Pacific SIDS	SPC, SPREP	Project initiated
World Bank / Brazil	Hydrogeological study of the North-Central region of the State of Tocantins	Brazil	Acacia Water, Panoaá Consult	Eol submitted
World Bank / ZAMCOM	Zambezi River Basin Management Project – component: Strategic Plan for the Zambezi Watercourse'	Zambezi Basin	Lead: IMWI Sub consultants: Antea group, UNESCO-IHE, PRIME AFRICA	Eol submitted
World Bank / ZAMCOM	Zambezi River Basin Management Project – component: Zambezi Water Resources Information System (ZAMWIS) Enhancement 3: Hydro-Met Database and Decision Support System	Zambezi Basin	Lead: Antea group Sub consultants: IMWI, UNESCO-IHE	Eol submitted Preparation of full proposal underway.

In addition to external project acquisition IGRAC has also initiated some internally funded activities/projects in 2015: E.g. the publication of a *Methodology on the Multi-Disciplinary Assessment of Transboundary aquifers*, internal project to perform additional analyses on the data

collected in the Transboundary Waters Assessment Programme (TWAP Groundwater), study to collect/process data on large national aquifers, etc. These activities are described under relevant sections in the next chapter.

3. CONTENT ACTIVITIES

IGRAC's content activities in 2015 were mostly continuation of previous activities, conducted in accordance with 'Work Plan 2014' and IGRAC's 'Strategic Planning 2012-2017.' To some extent IGRAC activities were also influenced by external factors and new developments but there was no significant deviation from the work plan. An important milestone in 2015 was the completion of large projects including DIKTAS, GGRETA and TWAP. The main structure of activities remained the same as previous years:

- Global Groundwater Information System
- Global Groundwater Assessment
- Global Groundwater Monitoring Network
- Knowledge Sharing and Groundwater Governance

This chapter provides an overview of the main activities and their outcomes. Additional information is available in project documents and other IGRAC products and services, as referenced to in the overviews below.

3.1 GLOBAL GROUNDWATER INFORMATION SYSTEM (GGIS)

The Global Groundwater Information System (GGIS) is IGRAC's interactive and web-portal to groundwater related information and knowledge. The main purpose of the GGIS is to assist in collection, storage and analysis of information on groundwater resources and its sharing among stakeholders such as water experts and decision makers. The system provides a global overview of aggregated information per country and per aquifer; detailed information for a selection of transboundary aquifers; and information sheets for 199 recently assessed transboundary aquifers. The map interface of the GGIS is complemented with a Meta-Information Module (MIM), where additional information and references are uploaded and linked to other data in the system. Software developed for monitoring within the GGMN application as well as IGRAC's other online databases are also considered a part of the GGIS.

3.1.1 Software development

In 2015, IGRAC finalised the development of the fully redesigned and expanded GGIS after nearly two years of design, development, testing and implementation. The system has been developed using open and extendable state of the art technology, making it possible to connect to more varied external data sources and systems through the internet. The user interface has been upgraded following specific requirements for usable data types, layout, GIS tools and web mapping services. All modules are built in the same environment to create consistency among user interfaces and to make it possible to combine data from the various projects. The accessibility, performance and user friendliness of the GGIS have been improved whilst also allowing more interactive participation of its users.

Development of a TWAP Groundwater viewer

The TWAP module of the GGIS allows the upload and storage of information collected through the groundwater component of the TWAP project. TWAP Groundwater is the first global baseline assessment based on systematically structured data of transboundary aquifers and groundwater systems of Small Island Developing States (SIDS). The TWAP viewer contains aggregated data on parameters, variables and project-specific indicators, altogether covering the hydrogeological, environmental, socio-economical and governance dimensions of the aquifer systems. The TWAP Groundwater viewer enables users to compare transboundary aquifers within the same region or across the globe. Users can browse and query a large number of thematic maps, download data in tabular format and download transboundary aquifer and SIDS groundwater information sheets.

Development of GGRETA Information Management System

As part of the GGIS redesign, IGRAC also developed a module for the Groundwater Resources Governance in Transboundary Aquifers project (GGRETA). The GGRETA Information

Management System provides detailed, map-based information on the three pilot transboundary aquifers located in: Southern Africa, Central Asia, and Central America. The portal is developed to collect, store, visualise and share information between (international) stakeholders and aims to be a tool in support of transboundary groundwater governance. The GGRETA system allows upload of various types of data, and the possibility to overlay different GGRETTA data into customized maps.

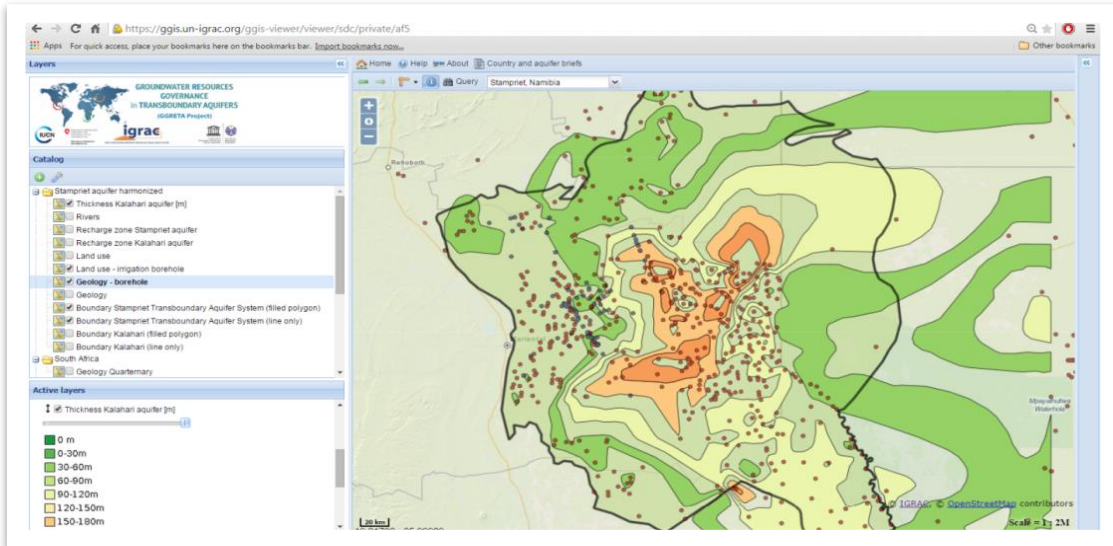


Fig 3. GGRETA IMS

Digital portal Map of Transboundary Aquifers of the World

In 2015, an online portal was set-up in the new GIS to provide access to all editions of the maps of 'Transboundary Aquifers of the World' produced by IGRAC (2009, 2012, 2014, and 2015) online. The digital version of the maps shows delineations of small aquifers and EU groundwater bodies that are not possible to visualised on a printed map. The viewer also provides basic information on individual transboundary aquifers and EU groundwater bodies.



Fig 4. Digital version TBA Map 2015

Development of Managed Aquifer Recharge Information System

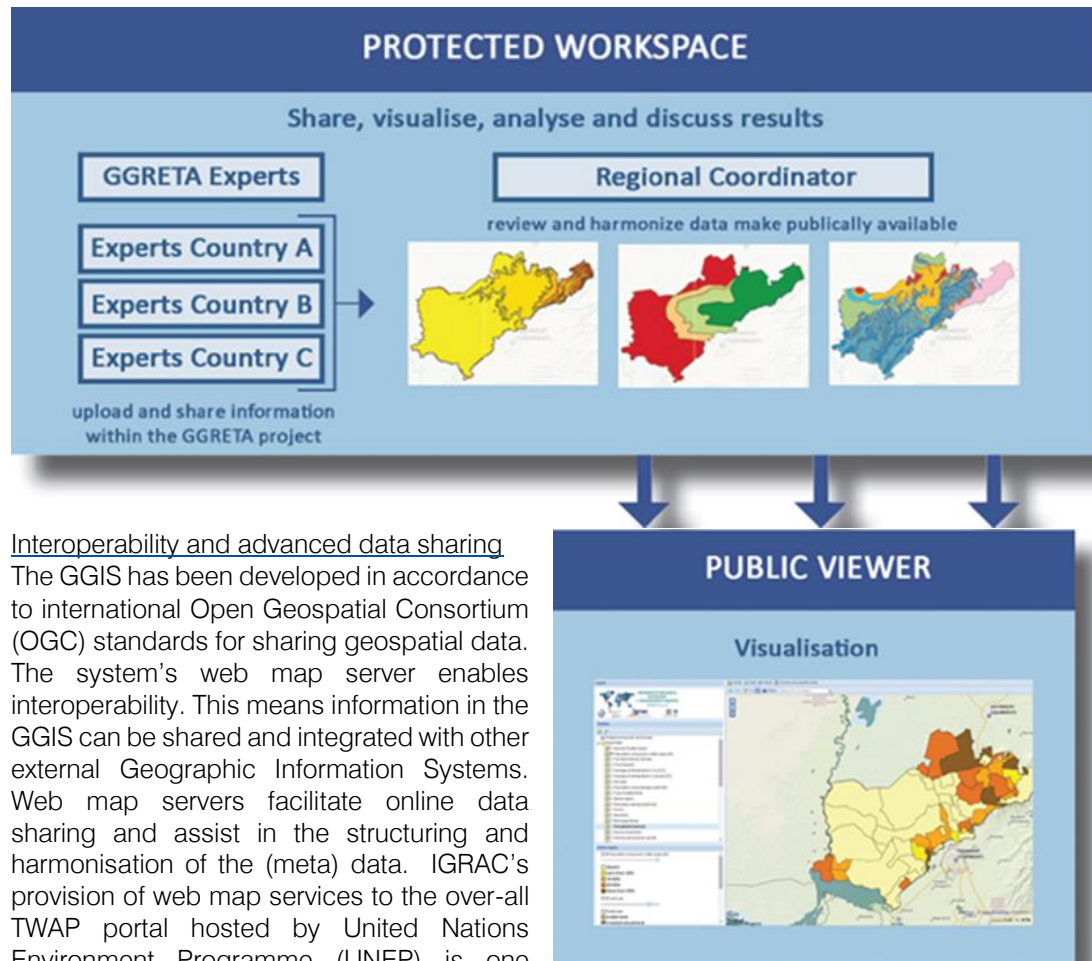
The Managed Aquifer Recharge Information System (MAR Information System) contains a global overview of MAR case studies and their relevant parameters. Available maps include location and information on MAR types, purpose of MAR, and end use of effluent. The data shown in this portal are available by INOWAS (TU Dresden, Germany and funded by the German Federal Ministry of Education and Research) and the DEMAU project (European Union FP7 project consortium).

Development of Information Management System for the Merti Aquifer

To improve the outreach and to increase visibility of the IGAD-MAR project (see chapter 3.2.3), the IGAD-MAR module was developed. The final maps include thematic groundwater maps and maps of areas with MAR potential. These were made available to share project results via the web and to facilitate information access and exchange between stakeholders and the IGAD member states for the IGAD Inland Water Resources Management Programme.

Password-protected workspaces

The GGIS has two types of workspaces. The first are public viewers that are freely accessible to anyone with internet access. The second are password-protected workspaces for projects that provide exclusive access to registered users. Authorised project partners can upload and manage the information in their workspace and decide which data will be made generally available to the public viewer. The password protected environment is particularly useful for sharing draft maps or information which is considered to be sensitive.



Interoperability and advanced data sharing

The GGIS has been developed in accordance to international Open Geospatial Consortium (OGC) standards for sharing geospatial data. The system's web map server enables interoperability. This means information in the GGIS can be shared and integrated with other external Geographic Information Systems. Web map servers facilitate online data sharing and assist in the structuring and harmonisation of the (meta) data. IGRAC's provision of web map services to the over-all TWAP portal hosted by United Nations Environment Programme (UNEP) is one example of this interoperability. Additionally, if IGRAC updates or amends these data, they will automatically be available to all external users without the need to make copies of data bases. A selection of web services is available on the IGRAC website for sharing purposes.

Fig 5. Protected and Public workspace

Redesign of the Global Groundwater Monitoring Network portal

In 2015, IGRAC commissioned the development of a completely redesigned web-application for the Global Groundwater Monitoring Network (GGMN). Improved functionality of the GGMN include performance, user-friendliness, use of international standards, improved visualisation of data availability in space and time, improved visualisation of groundwater change and spatial aggregation. New functionalities include a time series analysis tool, inclusion of a digital elevation model, land cover maps, download functionality, multiple log in per country or organisation and automatic import via web services. A first trial version of the new GGMN is online via ggmn.un-igrac.org.

3.1.2 Content update

The main content update of the GGIS in 2015 consisted of the following:

Transboundary Waters Assessment Programme (TWAP)

In TWAP large amounts of data have been collected for 199 transboundary aquifers and 43 groundwater systems of Small Island Developing States (SIDS). Indicators describing the general state of the aquifers have been calculated based on the collected data. All available data and indicators from the Global Inventory (TWAP questionnaire survey), WaterGAP global modelling and SIDS Groundwater inventory have been uploaded to the TWAP Information Management System (IMS), in total 224 data layers are now available in the TWAP IMS. All data can be downloaded as maps or excel files. Information on the aquifers has also been compiled in transboundary aquifer information sheets, which are now available for download in pdf-format. For more information, see on the TWAP project description further on in the report.

Groundwater Governance in Transboundary Aquifers (GGRETA) project

In 2015, spatially distributed data (such as shape files, geo-tiff and point data) for the three aquifers have been collected, processed and uploaded to the system. In total 29 layers for the Pretashkent aquifer, and 13 layers for the Stampriet aquifer have been uploaded to the system. At the request of the participating countries, most data are only available in the password protected environment. For more information, see GGRETA project.

Managed Aquifer Recharge Inventory

The GGIS MAR module contains integrated information collected through a European Union project consortium in the DEMEAU project. The information consists of point data with information on MAR sites in Europe. Additionally, data from a global inventory on MAR Sites from the TU Dresden, Germany are available. This global MAR database contains data on 1500 MAR sites worldwide, with for each site key information on construction, operation and aquifer properties. The first data have been added to the system in 2015 and more will be uploaded in 2016.

Training material and technical documentation on GGIS

IGRAC drafted instruction sheets and user manuals explaining the more advanced functionalities of the GGIS and in particular of the TWAP and GGRETA modules. The GGRETA manual has also been translated into Spanish. For internal use, IGRAC also drafted technical manuals for system administrators, which describe the advanced and 'behind the scenes' procedures related to the database management and publishing settings of map layers etc. In 2015 IGRAC also organised and conducted hands-on training sessions for GGRETA project partners. See 3.2.2 for more information.

3.2 GLOBAL GROUNDWATER ASSESSMENT

Groundwater assessment activities at IGRAC encompass country-based assessments, transboundary groundwater assessments and thematic assessments.

3.2.1 Global Country-based Assessment

Country briefs and the Groundwater Atlas of Africa in cooperation with BGS

In 2014 IGRAC developed briefs describing the state of groundwater resources in Bolivia, India, the Netherlands and Yemen. The country briefs are 3 to 5-page brochures that provide an overall picture of the country's groundwater resources in a standardised, short narrative that is supplemented with some graphical information. For 2015, IGRAC planned to develop more country briefs with the ultimate goal of creating briefs for all countries in the world. Yet, due to obligations from external projects and other activities which received a priority, progress in development of the country briefs has been very limited. Nevertheless, the agreement was made with British Geological Survey (BGS) on common storage and dissemination of country-based groundwater brief. This activity is planned for next year.

3.2.2 Transboundary Aquifer Assessment

Transboundary Aquifer Assessment remained the main IGRAC activity in 2015. Commissioned by UNESCO-IHP, IGRAC concentrated its activities on three large projects: TWAP, DIKTAS and GGRETA and one smaller, but innovative project on the Ramotswa TBA. Transboundary Aquifers of the World Map was updated as well. A brief description of main TBA assessment activities 2015 is given below.

Transboundary Water Assessment Programme (TWAP)

Recognizing the importance of transboundary water systems to humans and ecosystems, the fact that many of the water systems continue to be degraded and that most are managed in fragmented ways, the Global Environment Facility initiated the TWAP project (www.geftwap.org). IGRAC was previously involved in the TWAP medium-sized project (2009-2011) in which the methodology for an indicator based assessment was developed. In 2013 the TWAP full-sized project started. This programme is the first global comparative assessment of five transboundary water system categories: groundwater, lakes, rivers, large marine ecosystems and open oceans. The envisaged outcome is to provide the Global Environment Facility (GEF) and other international organizations with tools and information for setting priorities in activities related to sustainable management of transboundary water systems. The assessment is executed through institutional partnerships aiming to also seed future follow-up assessments. The TWAP groundwater component (www.twap.isarm.org) has assessed 199 transboundary aquifers and 43 groundwater systems of Small Island Developing States (SIDS). Data have been collected through networks of regional and national experts. The project is executed by UNESCO-IHP in close cooperation with IGRAC.



Fig 6. TWAP Viewer

The project started in April 2013 and concluded in 2015 after a no-cost extension. The final activities included the publication of final reports and launching of web based products including data portals.

IGRAC's main responsibilities have been coordinating the global data collection process, setting up the TWAP-groundwater information management system (TWAP IMS), providing technical assistance to all parties, contributing to the analyses and reporting, and over-all project management in conjunction with UNESCO-IHP.

Data collection was formally finalised by the end of 2014. In 2015, the focus has been on processing all data, collating all data and information into the TWAP Groundwater report and Transboundary Aquifer Information Sheets, finalising development of the TWAP Information

Management System (TWAP IMS), populating the TWAP IMS, and communicating project results. Activities in 2015 included:

- Project management: together with UNESCO-IHP, IGRAC formed the project management team for the TWAP Groundwater component. As such IGRAC was involved in all aspects of the project's organisation.
- Steering committee: Together with UNESCO-IHP, IGRAC represented the Groundwater component in the TWAP steering committee meetings. In 2015, remote meetings have been conducted using skype and conference calls and a face-to-face steering committee meeting took place in Paris in March 2015. IGRAC, together with other experts, represented the TWAP Groundwater team and took care of several presentations.
- Participation in the cross-cutting working groups (with the other water systems) on Governance and Data & Information Management.
- Coordinating technical harmonisation with Frankfurt University for global groundwater modelling component and Simon Frasier University Canada for SIDS-groundwater assessment.
- Being responsible for the data collection process through questionnaires (526 questionnaires have been sent out to 116 countries), IGRAC processed all questionnaires and finalised uploading of all information into TWAP database, performed basic quality checks (and liaised with national and regional experts as required), calculated indicators, assisted in drafting aquifer information sheets, etc.
- Finalising all improvements of delineations of transboundary aquifers has culminated in the publication of a new edition of the Map of Transboundary Aquifers of the World – 2015 edition, which was launched during the World Water Forum in Korea.
- IGRAC developed, tested and implemented the web-based Information Management System (IMS) for the TWAP Groundwater component enabling public access to all data collected in TWAP Groundwater (maps, documents and graphics). The TWAP IMS is developed as a module of the fully upgraded and redesigned GIS.
- Contributions to the TWAP Groundwater report, which combines and summarises the findings of the assessment of 199 transboundary aquifers, 43 SIDS groundwater systems and the results from the scenario studies through modelling. Contributions include processing comments from reviewers.
- Transforming / upgrading TWAP Groundwater component website from a project progress reporting site, to a website to communicate and disseminate final products.
- Presentation of TWAP (preliminary) results in several international conferences and meetings:
 - March 2015: TWAP Project Steering Committee & GEF Secretariat – Paris, France.
 - April 2015: 7th World Water Forum – Daegu & Gyeongbuk, Korea
 - May 2015: 16th World Water Congress – Edinburgh, United Kingdom
 - August 2015: UN Water conference – Stockholm, Sweden.
 - November 2015: United Nations Economic Commission for Europe (UNECE) meeting of the Parties to the Water Convention, side event - Budapest, Hungary.

DIKTAS project

Protection and Sustainable Use of the Dinaric Karst Aquifer System (DIKTAS) project (<http://diktas.iwlearn.org>) has started in 2010 and it is the first GEF project executed by UNESCO. IGRAC has provided the project manager and also contributes to various content activities. The total project budget is about 5.6M USD, wherefrom about 2.1M funding from the GEF and 3.4M in co-financing in kind by the project partners. IGRAC's total contribution to the project is about 1M USD, wherefrom approximately 40% is funded by GEF and 60% is in-kind.

The DIKTAS project was closed in 2015. Originally, the project was supposed to be closed in December 2014 but it was extended till June 2015 because of delays in preparation of the Transboundary Diagnostic Analysis (TDA) and organisation of the conference Karst without Boundaries in 2014. The second round of Inter-ministerial Committee (NIC) meetings was held in Bosnia and Herzegovina and Croatia in November 2014, in Montenegro in February 2015 and in Albania only in May 2015. In this second round, the NICs discussed a draft Strategic Action Plan (SAP) document and provided many comments and suggestions to be processed by the DIKTAS Project Team. The regional meeting of NICs was held in Trebinje 28th of May 2015, followed up by the Steering Committee meeting the next day.

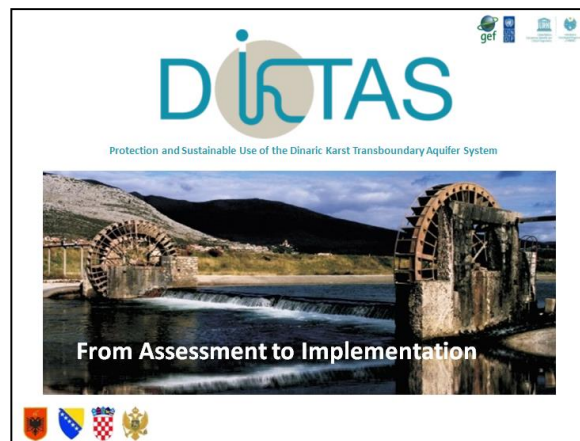


Fig 7. DIKTAS Project

The main conclusions from these meetings were as follows:

- DIKTAS was a successful project; with many lessons learned for future activities.
- The main achievements of the project are:
 - Improved knowledge on karst groundwaters in the Dinaric region mainly through implementation of the TDA and collecting, structuring, harmonising data;
 - Strengthened cooperation in the region through Project Team, National Interministerial Committees, Steering Committee;
 - Increased capacity and awareness through the Karst School, stakeholder workshops, conferences, publications, etc.
- Through these achievements the project has paved the way for further, broader cooperation in the region.

The project faced several challenges and most of them were overcome without major repercussions. However, some issues required more time and effort to tackle, leading to delays in the project execution. The main reasons for delay were the complexity of the TDA and the organisation of the conference; both legitimate reasons but the simple lesson learned is to plan more resources for activities which are not routine and/or highly dependant on external factors. There were, however, other reasons for delay as well, such as: changes of governmental representatives in the project (due to elections or other reasons); performance of some Project Team members, changes in the Project Coordination Unit (PCU), limited flexibility in UN rules and regulations on practical organisational matters, etc. Nevertheless, the delay was limited and the experience gained will be very useful for the next project phase.

The Steering Committee requested the extension of the project in order to prepare a concise version of the Strategic Action Plan. In September 2015, an extension of six months was granted.

The project Terminal Report was prepared and placed on a CD-ROM together with about 40 of the most important project documents. The CD-ROM also contains the produced project maps in various formats and all data collected during the project execution.

The concise version of the Strategic Action Plan was prepared in November 2015 and was submitted to the project countries for considerations.

The GGRETA project

Phase I of GGRETA started in April 2013. The project ran until December 2015 and was funded by the Swiss Agency for Development and Cooperation (SDC). It was executed by UNESCO-IHP with IGRAC as a major partner. The objectives of the first phase of the project were:

- to improve the knowledge and recognition of the importance and vulnerability of transboundary groundwater resources;
- to establish cross-border dialogue and cooperation;

- to develop shared management tools; and
- to facilitate governance reforms focused on improving livelihoods, economic development and environmental sustainability.

The focus of Phase 1 was on joint assessment of the selected transboundary aquifers and laying the foundation for joint management. Three transboundary aquifers were selected for the project: the Trifinio Aquifer between El Salvador, Honduras, and Guatemala; the Stampriet Aquifer between Botswana, Namibia, and South Africa; and the Pretashkent Aquifer between Kazakhstan and Uzbekistan.

IGRAC was responsible for data and information management and also provided technical support to the project management and national/regional expert teams. IGRAC's main activities in 2015 were:

- Providing guidance on the assessment methodology to project partners.
- Developing, testing and implementing of the final version of the web-based Information Management System (IMS) for the GGRETA project, enabling sharing between stakeholders of the final outputs (maps, tables, graphs, documents, etc.) from the three GGRETA case studies.
- Assisting UNESCO-IHP in general project management activities related to reporting to SDC and managing activities in the three case studies.

Stampriet case study: IGRAC contributed to the organisation and execution of four workshops in 2015:

- Regional technical workshop in Johannesburg – South Africa (February 2015)
- Regional technical workshop in Gaborone – Botswana (May 2015)
- Stakeholder meeting in Johannesburg – South Africa (July 2015), which on IGRAC's suggestion was organised in conjunction with the inception meeting of the RAMOTSWA project executed by IMWI (see below).
- Stakeholder meeting in Mariental – Namibia (November 2015)

Additionally, IGRAC helped draft the Stampriet case study assessment report and analyses.

Pretashkent case study: Throughout 2015, IGRAC provided guidance and technical assistance to the project's partners in Kazakhstan and Uzbekistan.



Fig 8. Field visit at Royal Eijkelkamp

IGRAC organised two training sessions in Delft, namely for Kazakh water professionals in February 2015 and for Uzbek water professionals in October 2015.

The trainings entitled 'Advanced Groundwater Monitoring Analysis' were organized in collaboration with UNESCO-IHE, Deltares, and Royal Eijkelkamp. The training introduced state-of-the-art knowledge on groundwater monitoring and related quantity and quality analysis. An introduction to monitoring and analysis equipment was provided in order to assess its suitability for operation in the region. The training covered various aspects of groundwater monitoring, including optimization of a groundwater monitoring network, water quality analysis, equipment required for water management and introduction of the GGMN Programme and the GGRETA Information Management System:

IGRAC and UNESCO also organized the workshop 'Added Value of Groundwater Management Systems' in Almaty, Kazakhstan to introduce the GGRETA information management system. Participants were trained to use the IMS and invited to thoroughly discuss its current and potential added values.

Trifinio Case Study: IGRAC, UNESCO-IHP and IUCN organised a one-week training course on the functionalities and use of GGRETA-IMS for the professionals of the project “Assessment of Groundwater Resources in the Trifinio Area.” GGRETA-IMS is the Information Management System-tool to store, visualise and share information collected during the aquifer assessment. The course took place at the Centenario Hotel in Esquipulas – Guatemala and was given by IGRAC’s coordinator for the Trifinio’s project. A follow-up training is planned for 2016.

Ramotswa Project

In December 2014, the International Water Management Institute (IMWI) invited IGRAC to be a partner in the project ‘Resilience in the Limpopo Basin: the Potential Role of the Transboundary Ramotswa Aquifer’. This USAID-funded project is a component of the Resilience in the Limpopo Basin Program (RESILIM) which supports the riparian countries of the basin in their efforts to improve shared management of water resources and equitably address the economic, environmental, and social needs of each country, thereby enhancing the resilience of the ecosystems and the people. The project supports equitable access to water that balances urban and rural needs with ecosystem requirements under a changing climate. It reduces climate vulnerability by promoting adaptation strategies for integrated, transboundary water resource management. By building the capacity of river basin organizations, national authorities and local communities to sustainably manage natural resources, high priority ecosystems and human communities will be resilient to climate-induced pressure.

The Ramotswa project addresses the overall objectives by critically examining the opportunities the freshwater aquifer offers in terms of climate adaptation and human induced changes such as pollution and depletion, while preserving and enhancing the resource and associated ecosystems through transboundary and local management.

IGRAC’s contribution to the first phase will be to set-up and manage the Ramotswa aquifer information system in the GGIS, to provide training in three workshops on the use of the system and on assessment as well as contribute to the analyses and reporting and possibly to scientific papers resulting from the project. IGRAC’s formal involvement in the project started in November 2015 and will continue until December 2016, additionally, a 2nd phase that would last until 2018 is under negotiation.

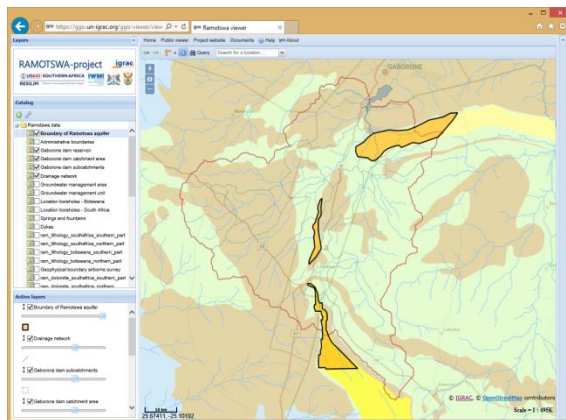


Fig 9. Ramotswa viewer

In 2015, IGRAC contributed to the Inception meeting of the project. Because of similarities and partial overlap in project partners, between the Ramotswa project and the GGRETA – Stampriet project, IGRAC suggested organising a joint meeting for the two project to create synergies. This joint meeting was organised in July in Johannesburg (South Africa).

In the last quarter of 2015, IGRAC also set up the first version of the Ramotswa Information Management System as a separate transboundary aquifer viewer within the Global Groundwater Information System. In

2016, the system will be further populated, training will be provided, and there will be a gradual handover to the national governments. IGRAC also developed a first draft of the Ramotswa Information Management System User Manual for advanced users.

Transboundary Aquifers of the World Map

IGRAC launched the 2015 edition of the map of Transboundary Aquifers of the World (TBA map) at the 7th World Water Forum in the Republic of Korea. In this new edition there are 592 identified transboundary aquifers, including transboundary 'groundwater bodies' as defined in the European Union Water Framework Directive (EU WFD). The map provides a global overview of these important, shared groundwater resources and intends to encourage further research and assessment thereof. In publishing this map, IGRAC aims to contribute to raising awareness on the importance of the governance of shared aquifer resources and to building the much needed global knowledge base.

This latest edition of the TBA map encapsulates information provided by various organisations and from projects dealing with transboundary aquifer assessments. A significant new source of information for the 2015 map was data collected as part of TWAP. The TWAP project resulted in minor changes to the delineation of 28 TBAs (change of surface area less than 10%), significant changes to 65 TBAs (>10% change in surface area) and added 53 completely new TBAs. The guiding principle in compiling the 2015 map was to stay as close as possible to the information provided by the individual sources, while presenting the information in a form that is appropriate for the chosen scale of the map (1:50.000.000).

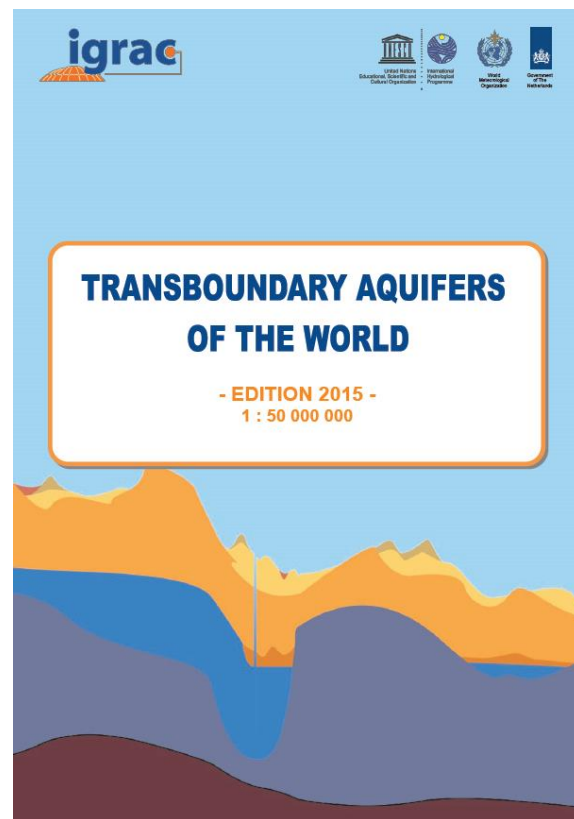


Fig 103. TBA Map 2015

New to the 2015 edition are the three thematic maps. These maps overlay the delineations of the (large) transboundary aquifers of the world with maps of climate zones, groundwater resources and recharge, and population density. Viewed side by side, these three maps give an indication of the potential for groundwater to contribute to sustainable development by showing the relation of climate, potential for groundwater recharge and potential human needs.

3.2.3 Thematic Assessment

In 2015, IGRAC conducted several thematic studies, including developing a TBA assessment methodology, analysis of global groundwater data, and implementing a data system for managing aquifer recharge.

Guidelines for Multidisciplinary Assessment of Transboundary Aquifers

In 2015 IGRAC, in cooperation with UNESCO-IHP, published 'Guidelines for Multidisciplinary Assessment of Transboundary Aquifers'. The guidelines were launched in draft form during the 42nd IAH congress in Rome in September 2015. Based on feedback received on this draft IGRAC will publish the final guidelines in 2016.

The guidelines are the outcome of several initiatives, including the Internationally Shared Aquifer Resources Management (ISARM) programme and the methodology developed for the Groundwater component of the TWAP project, funded by the GEF. Over the past few years, IGRAC further developed the methodology and it was tested in the three case studies of the GGRETA project funded by the Swiss Agency for Development Cooperation. The published guidelines have been prepared to assist in-depth assessments at aquifer level. Nevertheless, they can also be

used for comparative, regional assessments by aggregating data to the aquifer level and focussing on the indicators-based assessment.

Analysis of the global groundwater data sets

TWAP project yielded a significant volume of data on 199 of the transboundary aquifers in the world. Given the short time span and deadlines for TWAP, only a limited analyses was possible in the framework of TWAP itself. Therefore, IGRAC continued in-depth analyses of the TWAP Groundwater data sets in order to maximise opportunities that this important data set on could yield regarding transboundary groundwater. The in-depth analyses also included analyses of some of the background data (the 'raw' data from the questionnaires). The initial analysis focused on country segments where available data suggest a high human dependency on groundwater. These aquifer segments were evaluated based on groundwater development stress and their renewal capacity. Aquifer vulnerabilities and observed pollution patterns, natural and anthropogenic, were visualized in more detail. The analysis will be rounded off in 2016.

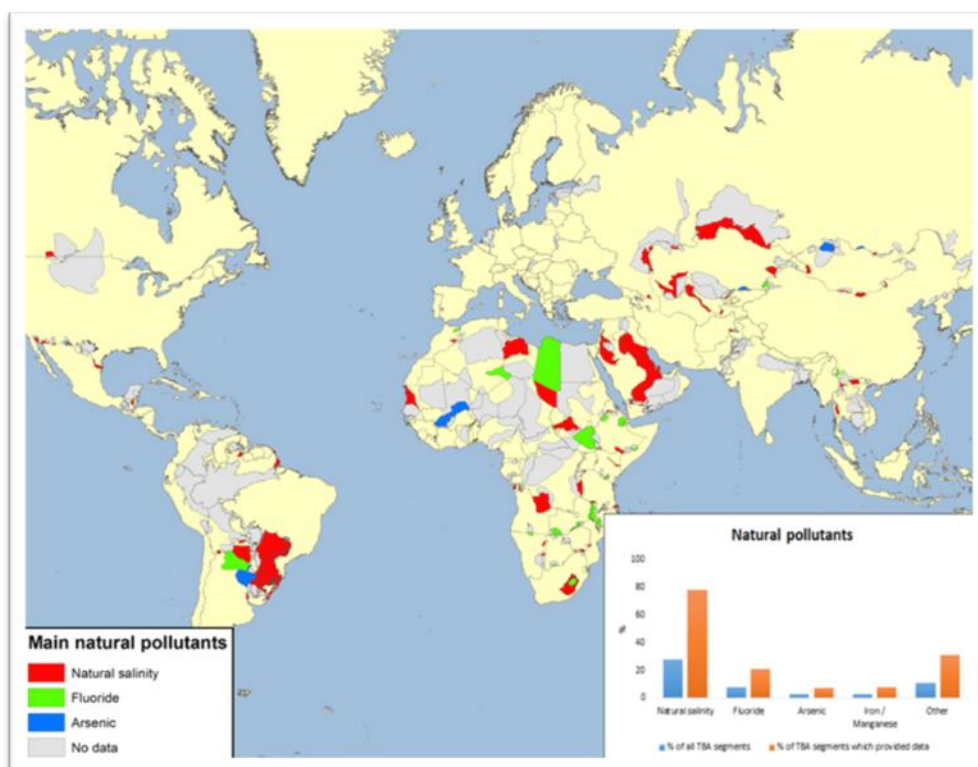


Fig 114. TWAP Natural Pollutants

From TBAs to Global Coverage - inclusion of large national aquifers

In 2015, IGRAC started work on a map and database of aquifers of the world, by complementing the map of *Transboundary aquifers of the world* with data on large national aquifers. In addition to creating a map with delineations of the (large) aquifers of the world, we also intend to include data on two indicators describing the state and importance of each aquifer: groundwater development stress (recharge volume divided by groundwater abstraction volume) and human dependency on groundwater. The figure below shows the step-wise procedure for delineating these aquifers.

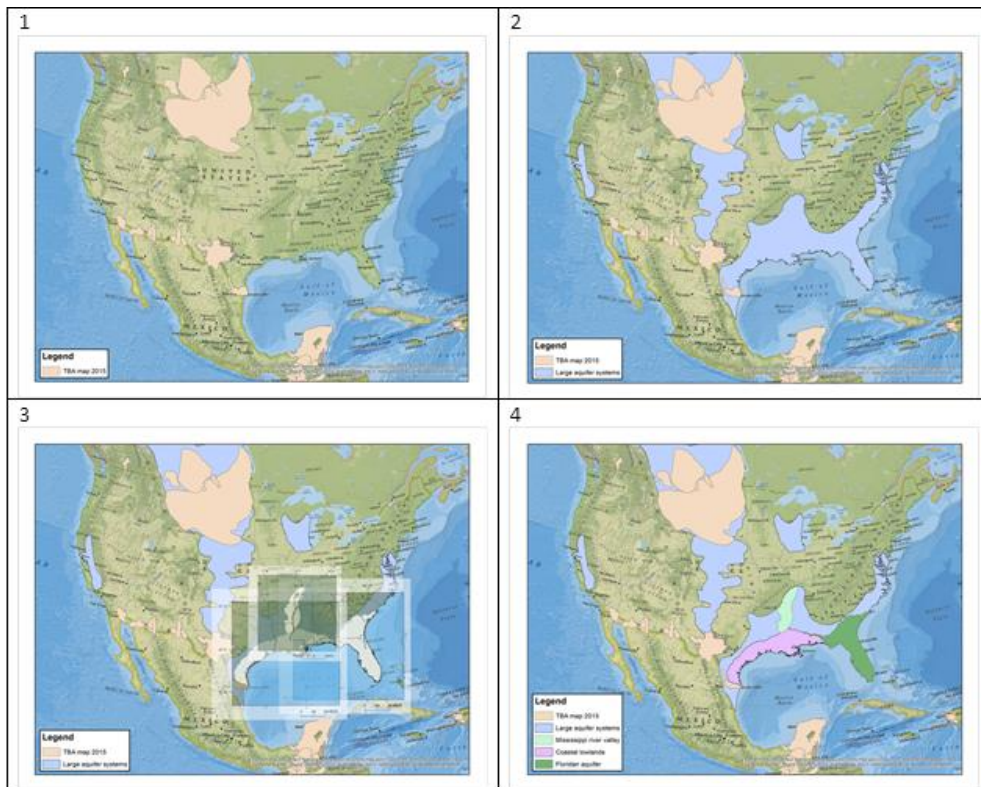


Fig 12. Inclusion of large national aquifers

Assessment of Sustainable Development in the Châteaguay Transboundary Aquifer

IGRAC hosted and guided Lea Weiss, an intern from the University of Utrecht – faculty of Environmental Sciences – from 1 July to 1 September. During her time at IGRAC, Lea assessed the potential for the sustainable development of the Châteaguay Transboundary Aquifer (shared between Canada and the United States) from a legal perspective. Adapting the conceptual and analytical framework developed but IGRAC’s PhD Research Fellow, Kirstin Conti, Ms. Weiss looked at the existing laws with direct and indirect applicability to groundwater in the aquifer. She identified strengths and weaknesses in these legal frameworks, assessed how the contents of the laws may or may not promote sustainable development and made recommendations in this regard. The report will be published in a concise form in coming months.

Data management system for the application of managed aquifer recharge in the Merti aquifer

In the first months of 2015, IGRAC and Acacia Water finished a consultancy project that designed and developed of data systems to support the application of Managed Aquifer Recharge (MAR) in the Horn of Africa. The project was awarded by IGAD/INWRMP to IGRAC with Acacia Water as a subcontractor. The project’s overall emphasis was to identify and map the potential for different MAR applications within the transboundary Merti Aquifer, shared between Kenya and Somalia, and the development of a MAR data management system. The potential of critical groundwater zones for current and future water supply and the potential of MAR to strengthen this resource were identified and mapped. The study was presented to key stakeholders in a 2-day workshop on MAR technology for the Merti aquifer in Naivasha, Kenya. This workshop was combined with a training session on the use of the MAR data system. The objectives were to promote the use of a

data-driven approach to MAR and to equip local experts with the knowledge and skills to apply MAR techniques.

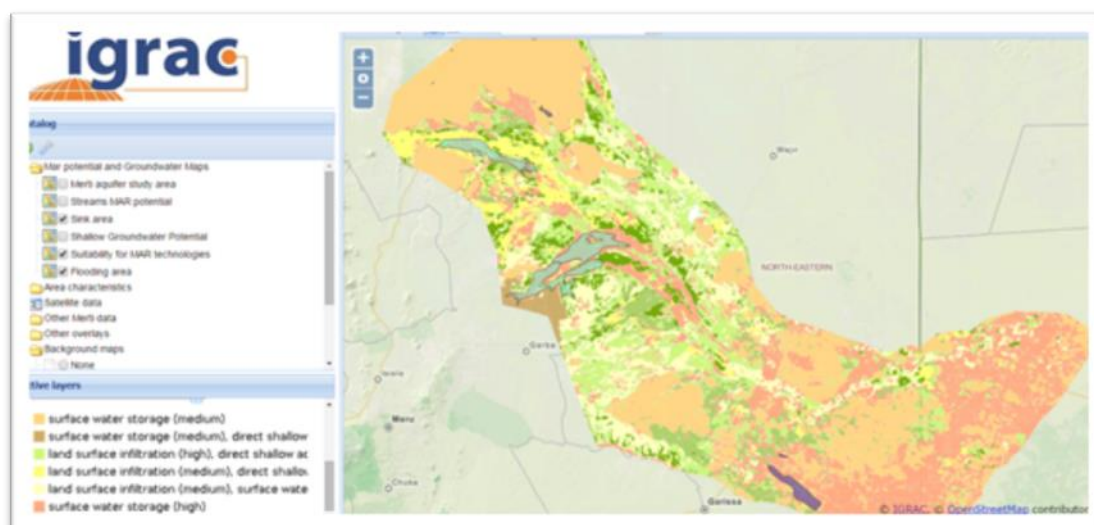


Fig 13. Data management system for the application of MAR in the Merti Aquifer

3.3 GLOBAL GROUNDWATER MONITORING

The Global Groundwater Monitoring Network (GGMN) is a participative, web-based network of networks, set up to improve quality and accessibility of groundwater monitoring information and subsequently our knowledge on the state of groundwater resources. GGMN is a UNESCO programme, implemented by IGRAC and supported by many global and regional partners.

In 2015 IGRAC began fully redesigning the GGMN web-application. The required developments are complex given that state of the art technology is employed and international standards for data sharing followed. With these improvement, the system is more robust and user friendly, enabling GGMN users to work with the system independently. IGRAC is investing about 100.000€ in the new GGMN portal. Detailed Software Requirement Specifications have been prepared and UNESCO-IHE is also involved in the development.

IGRAC contributed to the 7th panel session of the Global Terrestrial Network - Hydrology (GTN-H) in June in Koblenz, Germany. GTN-H links existing networks and systems for integrated observations of the global water cycle. The GTN-H is a joint project of the Global Climate Observing System (GCOS), the World Meteorological Organization / Climate and Water Department (WMO/CLW), and the Global Terrestrial Observing System (GTOS). Its goal is to provide comprehensive information on the total climate system where groundwater makes one of the essential climatic variables. IGRAC is responsible for the groundwater observations.

Two regional workshops were planned for 2015, one for Pacific Small Island Developing States (SIDS) with WMO and other for South-East Asia with UNESCO Bangkok office. Both workshops are postponed until 2016: the SIDS workshop because of local organizational issues and the Bangkok workshop because of delay in the software development.

3.4 KNOWLEDGE SHARING AND GOVERNANCE

Knowledge sharing is a part of all IGRAC activities and involves creating networks of people and development of services for these networks. Some activities listed below can also be seen as thematic developments but they do not necessary include assessment. These activities are dedicated to knowledge sharing (and governance) beyond the usual management structure. In the chapter below, a distinction is made between project-based activities and dissemination and outreach through publications, social media, events, etc.

3.4.1 Governance

Sustainable Development Goals (SDGs)



Fig 14. SDGs

In 2015, UN organisations and member states formulated a new agenda for development: 2030 Agenda for Sustainable Development, more commonly called the Sustainable Development Goals (SDGs). The SDGs were adopted in September 2015 by the United Nations General Assembly. They include 17 Sustainable Development Goals with 169 associated targets. The new Goals and targets came into effect on 1 January 2016 and will guide the decisions of UN organisations and member states over the next 15 years. A clear set of indicators and a coherent monitoring framework is required to track progress of achieving the SDGs. Therefore, the Global Environmental Monitoring Initiative (GEMI) is set up to address this need for SDG 6: 'Ensure availability and sustainable management of water and sanitation for all'. GEMI is an inter-agency initiative composed of the UNEP, the United Nations

Human Settlements Programme (UN-Habitat), the United Nations Children's Fund (UNICEF), Food and Agriculture Organization (FAO), UNESCO, the World Health Organization (WHO) and WMO, co-operating under the umbrella of UN-Water.

IGRAC already began contributing to GEMI in November 2014 during the inaugural meeting in Nairobi. A second, key meeting was held in Geneva in January 2015, where the GEMI programme was discussed with Member State representatives. Throughout 2015, IGRAC provided comments and suggestions on the proposed indicators for targets 6.3-6.6. IGRAC also supported UNESCO IHP and UNECE in their efforts to ensure inclusion of indicator 6.5.2 'Percentage of transboundary basin area with an operational arrangement for water cooperation.' Future involvement of IGRAC in GEMI will be determined by available funding. In the current GEMI planning, the UNESCO water family is designated roughly 2% of the total budget.

IGRAC released its second position paper on Groundwater in the SDG's entitled 'Groundwater in the Sustainable Development Goals – Emphasizing groundwater in the negotiations of the final goals.' This paper focused on the role of groundwater in the Draft Zero goals as authored by the UN Open Working Group on Sustainable Development Goals, particularly Goal 6. It also discussed the particular ways groundwater could be highlighted to enhance goal outcomes.

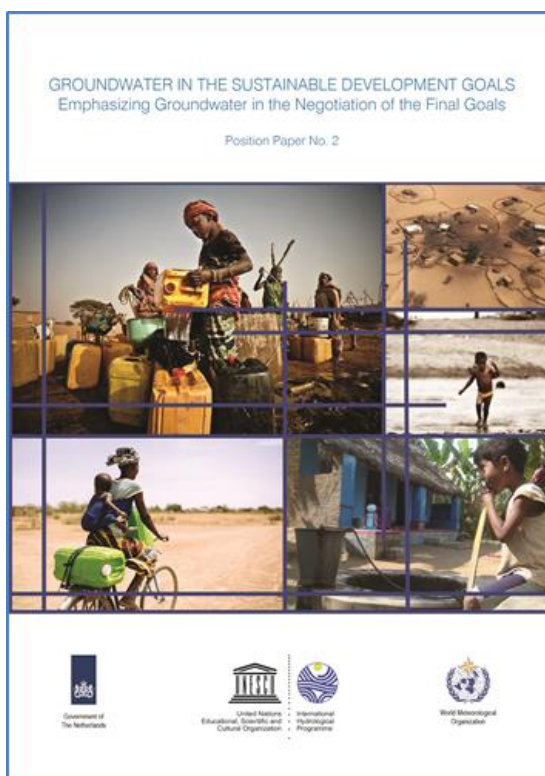


Fig 15. Second Position Paper on SDGs

Advanced Governance Assessment of the Stampriet Aquifer – PhD fieldwork

In May and June of 2015, IGRAC's PhD Research Fellow undertook field research in the Stampriet Transboundary Aquifer System, straddling Botswana, Namibia and South Africa. The fieldwork is part of the IGRAC funded PhD project entitled 'The Normative Framework for Sustainable Groundwater Governance: Principles and Patterns.' The objective of the research was to understand groundwater governance from both a normative and practical perspective. Over 60

interviews were conducted in the countries' capitals as well as at locations in the remote aquifer area. Conclusions were drawn regarding the potential for sustainable development of the Stampriet's groundwater resources and the impacts of a multi-faceted legal context on inclusivity in groundwater governance. The results from the fieldwork will be incorporated into the PhD thesis, and also inform the Swiss Agency for Development and Cooperation's (SDC) Project on Groundwater Resources Governance in Transboundary Aquifers (GGRETA).

Groundwater Futures in Sub-Saharan Africa (GroFutures)

The GroFutures project is a four-year initiative led by the University College of London and supported by the programme Unlocking Groundwater's Potential for the Poor (UpGro). UpGro is jointly funded by UK's Department for International Development (DFID), Natural Environment Research Council (NERC) and the Economic and Social Research Council (ESRC). It aims to develop the scientific knowledge and participatory processes by which groundwater resources can be used sustainably for poverty alleviation in Sub-Saharan Africa. The work is focussed around 3 focal 'Basin Observatories' comprising the Upper Awash (Ethiopia), Great Ruaha (Tanzania), and Iullemeden (Niger/Nigeria/Benin/Burkina Faso). IGRAC has two roles in the project:

1. The project Information Management Strategy will employ IGRAC's Global Groundwater Monitoring Network to disseminate the results of the project;
2. IGRAC will help decision makers and stakeholders to transparently consider trade-offs associated with development pathways by improving and applying the Groundwater Serious Game 'Tragedy of the Groundwater Commons' (GW-GAME).

In 2015 IGRAC has further improved the GW-GAME, set-up a share point site for sharing of project documentation and participated to three project meetings:

- The UPGro kick-off meeting in London – United Kingdom (April 2015): The main purpose of this meeting was to better understand the aims and activities of the other UPGro Consortium projects so that research activities, dissemination, and engagement across the UPGro programme would better be coordinated. IGRAC staff guided the Play & Dialogue test-session of the GW-GAME at the Geography department of UCL with the participation of nine UCL fellows.
- The GroFutures workshop in Addis Ababa - Ethiopia (June 2015): The aim of the workshop was to train the team of social scientists involved in the project. The workshop started with an overview of the main goals of the project and the work package relevant to the social scientists. IGRAC staff led the Groundwater Game for a group of 11 participants. IGRAC further contributed to brainstorm sessions to characterise the three project basins in terms of its physical and social aspects and to identify relevant stakeholder groups in the basins.
- The GroFutures Inception workshop in Addis Ababa – Ethiopia (September 2015): The event was attended by 25 professionals from the 12 participating organisations, which are based in 11 different countries. IGRAC organised a 'Play & Dialogue session' of the GW-GAME for the entire project team. The session provided an opportunity to the physical scientists to get to know the game and to bring their suggestions and comments. The workshop also included a field trip to the Upper Awash basin and presentations/discussions regarding contribution to the project for the different organisations involved and exchanges of ideas on the necessary adaptations to the basins' physical and social context.

Groundwater Serious Game

In the past, IGRAC developed a Groundwater Serious Game based on Garrett Hardin's theory and article 'The Tragedy of the Commons' (1968). As a contribution to the GroFutures project, IGRAC has further improved and tested the Game in 2015. The game is used in the project as an awareness rising tool between stakeholders; it assists them to understand the dilemmas faced by small-scale farmers seeking effective and equitable ways to manage their groundwater resources individually and collectively to irrigate their land.

In total, four 'Play & Dialogue' sessions have been held to test and collect feedback on the game: (1) in April at UCL in London, (2) in June at IWMI in Addis Ababa, (3) in September at the IGRAC office and (4) in September at University of Addis Ababa. After each test session the game has been modified based on the observations made and the objectives to be reached. Three of these sessions were part of the GroFutures' project related activities. Some features of the game that have been modified based on these sessions. These included the total number of playing rounds, the amount of hectares to be brought into production, and the interference of the wells on each other's pumping rates, amongst others. These adjustments shortened the duration of game, making it easier to fit into the time constraints of an event/meeting, and made the game more realistic to the situation of small scale African farmers.

Quantifying the benefits of transboundary water cooperation

IGRAC drafted both a conceptual and case study contribution to the UNECE initiative "Quantifying the benefits of transboundary," which aims to develop a policy guidance note for UNECE Water Convention parties. Content contributions discussed the role of groundwater in using economic approaches to bolster transboundary water cooperation. The case study focused on results of IGRAC's previous analysis of groundwater economics in the DIKTAS region. The case study has been integrated in the Draft Policy Guidance note released in 2015. The concept contributions may get integrated in a later phase.

3.4.2 Knowledge Sharing and People Networks

Free and open source software for water resources management (FREEWAT)

FREEWAT is a HORIZON 2020 project financed by the EU Commission under the call *Water Innovation: Boosting Its Value for Europe*. FREEWAT aims at promoting water resource management by simplifying the application of the Water Framework Directive and other EU water-related directives. FREEWAT's main output will be an open source and public domain GIS integrated modelling environment for the simulation of water quantity and quality in surface water and groundwater. It will also include an integrated water management and planning module.

In 2015, there were several meetings and work-sessions related to developing IGRAC's role in the project. IGRAC has also assisted UNESCO-IHP in setting up a program with USGS for MODFLOW training. This training was given in the Stampriet region in December 2015 in the framework of FREEWAT and HOPE. IGRAC has also taken part in self-training in QGIS software. The objective of this self-training activity is to build a capacity in using QGIS as a basis for performing the further FREEWAT activities.

The contract defining IGRAC's formal participation in the project consortium was finally signed in December 2015. IGRAC's main role in the FREEWAT project will be to contribute to capacity building and promote the use of FREEWAT in the Stampriet case study area.

WMO manual on Water Resources Assessment

IGRAC contributed to the WMO Manual on Water Resources Assessment, which was developed under the framework of the Commission of Hydrology's activities on water resources assessment. The manual is developed to provide National Hydrological Services and other operational agencies with state of the art methods for assessing the water resources availability and potential of its exploitation at the national, subnational or regional scale in support of Integrated Water Resources Management. The manual deals with both surface and groundwater resources.

An expert meeting was held in Geneva, Switzerland to discuss and finalizing the structure and form of the manual, reviewing the work done by the consultant in charge of designing its content and collecting inputs and suggestion for its finalization. IGRAC developed a chapter of the manual and a case study on aquifer assessment. The manual is expected to be finalised and published in 2016.

IW LEARN

In January 2015, IGRAC with the support of UNESCO-IHP hosted a webinar entitled “Moving with the Momentum: Reviewing Lessons for Groundwater from 2014 and a Looking Ahead to 2015.” The webinar included five presentations from eight presenters covering a range of topics relevant to groundwater governance. All the presenters were well prepared and enthusiastic. There were 45-50 attendees in total, a majority of which stayed for the duration of the webinar. Several of IGRAC’s key project partners were also in attendance. IGRAC made significant contributions to the content and technical execution of the webinar including moderating the event, presenting on the SDGs, the TWAP programme and the new edition of the map of Transboundary Aquifers of the World; confirming other speakers; collecting, organizing and formatting presentations; managing software; setting up a location on the IGRAC website dedicated to the webinar; and formatting the event recording. For future web summits, we hope to increase audience participation and engage presenters from a broader range of geographic locations.

Rural Water Supply Network Webinar series

In late 2015, the Rural Water Supply Network (RWSN) launched a series of ten webinars on topics related to rural water supply, among them equality, sustainable services, groundwater, self-supply approaches, rainwater harvesting and human rights. IGRAC participated on the webinar entitled “The magic and mystery of groundwater data” and gave a presentation on issues encountered when trying to harmonized data obtained from neighbouring countries sharing the same transboundary aquifer. Examples were used from the Stampriet aquifer case study performed under the framework of the SDC-funded “Groundwater Resources Governance in Transboundary Aquifers” project.

Capacity building and education

Even though it is not one of IGRAC’s core activities, IGRAC aims to contribute to capacity building in groundwater monitoring, assessment and governance through specialized training workshops and on-the-job training.

In 2015, this activity also included supervising PhD research (on karst hydrogeology in cooperation with Karst Water Institute in Slovenia) as well as lecturing, supervising and examining MSc students at UNESCO-IHE.

3.4.3 Publications and communications

Publications:

- Transboundary Aquifers of the World Map 2015:
The 2015 Map of Transboundary Aquifers of the World (TBA Map 2015) shows the information presently available on the occurrence and extent of Transboundary Aquifers worldwide. The majority of changes with respect to the previous edition are the result of TWAP, which in turn has made use of the results of many projects carried out around the world. This 2015 special edition also includes three thematic maps on world climate, groundwater resources & recharge and population density. The TBA Map 2015 is also available online at IGRAC’s GGIS where the map can be explored in more detail in combination with all previous editions of the map.
- Groundwater in the Sustainable Development Goals: Emphasizing Groundwater in the Negotiation of the Final Goals - Kirstin Conti, IGRAC
This position paper is the second in a three-part series. This series spans the Post-2015 Sustainable Development Goals (SDG) process and is designed to discuss strategic points of intervention related to groundwater prior to the development of the draft SDGs (Position Paper No. 1); after the release of the draft and during the negotiation of goals by UN member states (Position Paper No. 2); and after the entry into force of the final SDG text (Position Paper No. 3). The objective of this series is to emphasize the critical role that groundwater has in the 2030 development agenda and ensure that relevant stakeholders make “the invisible resource”, visible in their policy, planning and monitoring activities over the next 15 years.

- [Guidelines for Multidisciplinary Assessment of Transboundary Aquifers](#)
The first draft of “Guidelines for Multidisciplinary Assessment of Transboundary Aquifers” was presented at the IAH Congress held in Rome, Italy. This first draft was distributed at the congress and later published on the IGRAC website with the objective to receive comments and feedback from experts. These comments will be used as input when writing the final version of the guidelines. This final version is expected to be published in the first half of 2016.
- [IGRAC contribution to World Water Development Report 2015](#)
IGRAC has contributed to the World Water Development Report 2015, which has been launched at the official celebration of World Water Day 2015. IGRAC has provided the Groundwater Development Stress (GDS) Map for the WWDR 2015, titled 'Water for a Sustainable World'. Moreover, IGRAC's map of arsenic traces in groundwater in Asia was included in the Case Studies and Indicators document titled 'Facing the Challenges'.
- [Transboundary Shale Aquifers of the World Map](#)
IGRAC has made a map which overlays its Transboundary Aquifers of the world map 2015 with a shale layer. The aim of this map is to provide a global overview of the spatial relationships between transboundary aquifers and some of the major shale potential and extraction. This 'Shale Transboundary Aquifers Map' has also been included in the Global Overview module of IGRAC's GGIS.
- [GRAPHIC position paper](#)
IGRAC contributed to the preparation of the new GRAPHIC position paper (Groundwater and climate change) that has been prepared for COP21. IGRAC's position paper (Conti, 2014) was mainly used as inspiration and additional suggestions were later provided regarding effects of climate change on natural groundwater quality and the importance of groundwater monitoring as a management strategy to reduce vulnerabilities.

Communications:

New IGRAC website

The main novelty in terms of communications has been the development of IGRAC's new website (www.un-igrac.org). In August 2015, IGRAC launched its new website with improved functionality, design and navigation. A new and improved website was needed to meet today's web-browsing requirements. For example, unlike the previous website the new one is fully responsive, which means that the interface changes when visiting the IGRAC website using tablets or mobile phones.



Fig 16. New IGRAC website launched in 2015

Another major change is the integration of social media, which allows users to easily share interesting content with their network by Twitter, Facebook, LinkedIn, Whatsapp and many other channels. Also the Downloads section has been improved in terms of usability. Users can browse through the available resources, using the search function or the dropdown to either search by topic, resource type or keyword.

Apart from these technical improvements, this new website also contains some new sections and updated content. For example, the ‘What is groundwater?’ page, which explains the groundwater basics. In 2016, this section will be expanded to cover more groundwater-related topics.

New ISARM Website

The new ISARM website (www.isarm.org) was launched in December 2015. The previous website was developed at the start of the ISARM Initiative in 2002 and therefore, become outdated. In contrast to the previous website, the new ISARM website is fully responsive and therefore more suitable for mobile devices.

UNESCO-IHP Groundwater Portal






Fig 17. UNESCO-IHP Groundwater Portal launched in 2015

The Groundwater Systems Section of UNESCO-IHP initiated the development of a new web portal that highlights UNESCO's groundwater activities. IGRAC was asked to lead this development process.

Before starting the developments, IGRAC's Communication Specialist interviewed several UNESCO-IHP staff members in order to define UNESCO-IHP's wishes and requirements for the Groundwater Portal. Then a set of requirements were defined and the portal was developed based on these interviews and the Communication Specialist's own expertise. The portal can now be found at: www.groundwaterportal.org.

Social Media

After setting up IGRAC's social media channels in 2014, a few goals were set in the 2015 Work Plan in terms of social reach. Table below that shows progress throughout 2015:

	Followers in 2014	Goal for 2015	Followers in 2015	Growth
	190	760	13,234	+ 6,865 %
	74	296	743	+ 904 %
	85	340	175	+ 106 %

IGRAC Brochures and Public Relations Material

In 2015, IGRAC developed several print materials dedicated to IGRAC's activities. Leading up to World Water Forum 7 in Daegu, IGRAC developed a 4-pager highlighting its transboundary assessment activities and a Z-Card exclusively focusing on the groundwater component of TWAP (see image below).



Fig 18. New IGRAC Corporate Profile

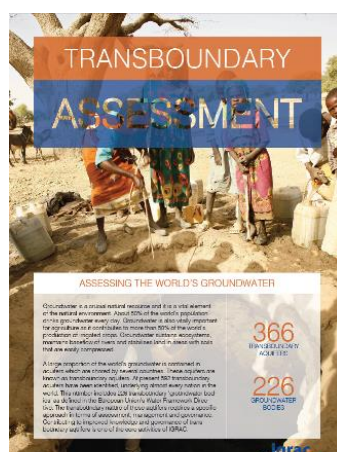


Fig 19. Transboundary Assessment



Fig 20. TWAP Groundwater ZCard

PRINT MATERIAL	COPIES DISTRIBUTED IN 2015
Corporate Profile	1,500
Transboundary Assessment	1,250
Transboundary Aquifers of the World Map 2015	1,000
IGRAC Corporate Brochure	750
SDG Position Paper 1	750
SDG Position Paper 2	750
TWAP Groundwater Z-Card	500
GGMN Brochure	500
DIKTAS booklet incl. CD-ROM	200
GGRETA Information Management System (English)	200
GGRETA Information Management System (Russian)	100
Draft Guidelines for Multidisciplinary Assessment of Transboundary Aquifers	100
Factors Enabling Transboundary Aquifer Cooperation: A Global Analysis	100
Groundwater around the World	100
TOTAL	7,800

3.4.4 Events

This brief overview includes only the events that were not a part of IGRAC content activities described in sections 3.2 and 3.3.

- [7th World Water Forum in Daegu, Republic of Korea](#)
The 7th World Water Forum was held in the Republic of Korea from 12 to 17 April 2015. The World Water Forum is the world's largest meeting on water and is held every three years. IGRAC participated in this major event with several presentations. IGRAC presented DIKTAS and the groundwater component of TWAP, organised the official launch of the 2015 Edition of our TBA Map and was represented in the UNESCO Water Network booth at the Expo & Fair.
- [World Water Congress XV in Edinburgh, Scotland](#)
IGRAC presented 'Worldwide Assessment of Transboundary Aquifers with focus on the African Continent' during the 15th World Water Congress in Edinburgh, Scotland. The presentation was part of session 'Transboundary Water Resources: Aquifers', which was held on Wednesday 27 May 2015. The presentation focused on the baseline assessment undertaken as part of TWAP groundwater.
- [World Bank Partnership Roundtable on Groundwater in Delft, the Netherlands](#)
Together with NWP (Netherlands Water Partnership) IGRAC organised a 'Roundtable on Netherlands Groundwater Expertise in Integrated Delta Management'. Mr. Junaid Ahmad, Senior Director Water at The World Bank, met representatives of Dutch groundwater sector to hear about groundwater management practice in the Netherlands and to explore possibilities to implement related knowledge into World Bank operations.
- [42nd IAH International Congress in Rome, Italy](#)
IGRAC presented the Information Management System (IMS) and a poster about the IGAD MAR project. IGRAC staff also participated in the GRAPHIC back-to-back meeting and the IAH Transboundary Aquifers (TBA) Commission meeting. IGRAC and UNESCO-IHP shared the booth.
- [Waarde van Grondwater Symposium in Nieuwegein, the Netherlands](#)
In September, Neno Kukuric gave a presentation about groundwater in relation to climate change during the symposium 'De Waarde van Grondwater' (Value of Water) held at the KWR Watercycle Research Institute in Nieuwegein. This event was co-organised by IGRAC in cooperation with IAH, KWR, Deltares, NHV and VVM.
- [Workshop 'Integrated Water Resource Analytical Techniques and Remote Sensing Applications in Support of Water Resource Assessments in Central Asian Countries' in Astana, Kazakhstan](#)

IGRAC presented the GGIS during the international training workshop 'Integrated Water Resource Analytical Techniques and Remote Sensing Applications in Support of Water Resource Assessments in Central Asian Countries'. This workshop which was held in Astana, Kazakhstan, from 14 to 18 September, was organised by UNESCO, JSC, ISTC and USGS. Delegations from Afghanistan, Kazakhstan, Kirgizstan, Pakistan, Tajikistan, Turkmenistan and Uzbekistan all participated in this workshop.

- 50 Years, 50 Movies on Water

This year, IHP celebrated half a century of water-related achievements with a series of film screenings, entitled "50 Years, 50 Movies on Water", which took place every two weeks from 25 June to 12 November 2015 at the Open UNESCO exhibition space. Each of the screenings focused on a different water-related challenge and solution that was introduced by an IHP professional or partnering expert, and concluded with a participant discussion. On 1 October, IGRAC's video 'Groundwater, the Hidden Resource' was screened during the session on 'Ecohydrology, Engineering harmony for a Sustainable World & Groundwater in a Changing Environment'.

- 197th UNESCO Executive Board in Paris, France

On Tuesday October 13th, IGRAC was presented to delegates of the member states of UNESCO, during the 197th UNESCO Executive Board. During the session "Groundwater: Our Hidden Resource", the main objective was to show the importance of groundwater as freshwater source and discuss how IGRAC as UNESCO Category II Centres could assist Member States.

- International Conference of the Commission on Legal Pluralism in Mumbai, India

IGRAC presented on 'Methods for Global Assessment of Legal Plural Regimes: Applications to Groundwater Governance' during the biennial international conference of the Commission on Legal Pluralism, which took place from 14 to 16 December 2015 at the Indian Institute of Technology (IIT) in Mumbai, India.

4. BUDGETING

The state of IGRAC's budgetary affairs at the end of 2015 is summarised in the table below. There is a Financial Statement Report (in Dutch, 26p) produced by an external bureau for the IGRAC Foundation Board and it is available on request.

Budgetary items (amounts in Euro)	
	Calendar year 2015
INCOMES	
Base subsidy	500000
Projects and Services ¹	387230
Total incomes	887230
EXPENCES	
Direct project costs	274828
Gross company result	612402
Wages and salaries	215526
Social security contributions	43749
Pensions	39626
Staff subcontracted (advisory, phd, interns)	3463
Staff costs - miscellaneous	17535
<i>Total staff costs</i>	319899
Software development costs	54589
Office rent	18108
Office costs	10798
General costs (insurance, fin. admin, etc.)	69536
Total company expenses	472930
Bank account interests and costs	5644
Result 2015	145116
Accrued liabilities ²	-119927
Previous year balance	417924
General reserve condition	443113

¹ Including UNESCO contract from October 2016 for an amount of 106000\$ (ca 96735€). IGRAC delivered contracted products and services. The payment will be made in 2016.

² In 2015, IGRAC contracted software developer for 85000€ to redevelop the GGMN. A half of this amount is paid in 2015, the other half of will be paid after the software delivery in 2016. The GGIS development contract (made in 2015) is for two years, including 30086€ for hosting and use of the cloud services in 2016. There is additional contract for GGIS upgrade of 32025€. Accrued liabilities are in total 119927 inc. VAT).

The Minutes

from the fifth meeting of the

Governing Board

Held in Delft on 18th December 2015

Present:

Ms. Elaine Alwayn, the chair (Ministry of I&E, NL)
Ms. Alice Aureli, a member (UNESCO-IHP) (via conference call)
Mr. Fritz Holzwarth, a member (UNESCO-IHE) (left earlier)
Mr. Julius Wellens-Mensah, a member (WMO)
Mr. Neno Kukurić, secretary of the Board (IGRAC)
Ms. Monique Berendsen, IGRAC liaison at the Ministry of I&E, NL
Mr. Joop de Schutter, the chair of the IGRAC Foundation Board
Mr. Youssef Filali Meknassi, UNESCO-IHP (via conference call)

Absent: none

The chair Ms Alwayn opened the meeting at 9.30, welcomed the participants and especially Ms Aureli who could not attend the meeting in person because of very recent injury, therefore attending the meeting via a conference call. Ms Alwayn announced that Ms Berendsen has replaced Mr Vlaanderen as a contact person at the Ministry of Infrastructure and the Environment of the Netherlands (further in the text: the Ministry) and invited Ms Berendsen to introduce herself. Ms. Berendsen shortly informed the Board that she is a senior policy adviser at the Ministry and a contact person for UNESCO-IHP, UNESCO-IHE and IGRAC.

Subsequently, Ms Alwayn asked for adoption of the proposed agenda. Ms Aureli stated that she will provide some information on renewal and agreement within the agenda item Future of the Centre but she would also like to discuss the UNESCO-IHP/IGRAC database that has been developed at IGRAC, also in relation with the Member States. Accordingly Ms Alwayn suggested adding a sub-item UNESCO-IHP/IGRAC database under the agenda item Future of the Centre.

The agenda was adopted with this remark:

Agenda

- 9.30 - 9.45: Welcome, adopting the agenda
- 9.45 - 10.00: Adoption of previously sent documents:
 - Governing Board Minutes of the Meeting 2014
 - IGRAC Report 2014
- 10.00 - 10.20: IGRAC State of Affairs (December 2015)
- 10.20 - 10.40: IGRAC Work Plan 2016

- 10.40 - 11.10: Discussion on State of Affairs & Work Plan
11.10 - 12.00: Future of the Centre (2016-2021) including:
- Evaluation procedure
 - Renewal of the IGRAC Agreement
 - UNESCO-IHP/IGRAC database
 - Financing in 2016
- 12.00 - 12.15: Conclusions and agreements
12.15 - 12.30: Any other business
12.30: Closing the meeting

Ms Alwayn asked Mr Holzwarth which part of the agenda was the most interesting for him since he could not attend the whole meeting. Mr Holzwarth replied: the State of Affairs and the Work Plan. Then Ms Alwayn suggested proceeding with these items firstly and to adopt previously sent documents later in the meeting. The Board agreed with this suggestion.

IGRAC State of Affairs and Work Plan 2015

Requested by Ms Alwayn, Mr Kukurić presented the State of the Affairs 2015 and the Work Plan for 2016. (The presentation is available on the IGRAC memory stick that the participants of the meeting received).

Mr Kukurić presented the state of the affairs and the work plan for 2016 as a combined presentation that included institutional activities, content activities and financing.

Institutionally, UNESCO-IHP Secretariat has been IGRAC main partner in 2015 and will hopefully remain in 2016. IGRAC is executing projects for UNESCO-IHP and the both parties have made considerable effort to develop the most optimal working relationship. The main obstacle is still the rather ambivalent position of UNESCO category II centres (like IGRAC): The UNESCO-IHP Secretariat would like to see IGRAC as an integral part of UNESCO, while the UNESCO administration deals with IGRAC in the same way as with any other external (commercial) partner. This ambivalent position leads to complications in interpretations of agreements and contracts, different expectations and consequently reduced effectivity in common activities.

Cooperation with WMO has intensified in 2015, and IGRAC aims to maintain this upward trend in 2016.

IGRAC has continued its efforts to get actively involved in the activities of the World Bank; IGRAC has support of the staff at the bank but still the way should be found to realise the involvement because IGRAC is not a consultancy, neither a country member nor a United Nation agency/programme. UNESCO, for example, has a procurement agreement with the Bank but IGRAC cannot use it being legally not UNESCO.

Cooperation with UNESCO-IHE is good but it can be extended. The cooperation with the Secretariat of the IHP-HWRP programmes in the Netherlands has increased since the new (two) secretaries were appointed.

The IGRAC Foundation Board had its regular meeting in April 2015. The Foundation Board is assisting IGRAC in managing the foundation (by controlling and advising). The new meeting is planned for April 2016.

A meeting of the Technical Advisory Committee (TAC) which has been postponed in 2015 should take place once there is clarity about the future of the centre; this in connection with a new strategic programme for the coming period.

There was no increase of IGRAC staff in 2015; two temporary contracts were extended for a limited period again due to insecurity related to funding of the centre in coming years. The third temporary contract was not extended at IGRAC but a temporary contract was made through UNESCO-IHP. At the moment IGRAC has seven staff members, including one PhD student.

Mr Kukurić then presented an overview of project leads, new ideas and initiatives. IGRAC has a small team and it is not easy to make IGRAC attractive as a partner for large organisations; nevertheless, IGRAC succeeded to acquire a couple of projects in the SADC and IGAD regions in Africa, and a number of Expression of Interest were prepared for possible projects in the next year.

IGRAC content activities in 2016 will mostly be a continuation of activities from previous year(s), and in accordance with the IGRAC Strategic Planning including:

- Global Groundwater Information System
- Global Groundwater Assessment
- Global Groundwater Monitoring Network
- Groundwater Knowledge Sharing and Governance

The most main components of the Global Groundwater Information System (GGIS) have been completed in 2015 although some improvements will be carried out in 2016, along with development of new modules. The GGIS is a contemporary and interactive system, hosting quite some data, which is for the first time that UNESCO has such a database. Mr Kukuric briefly demonstrated the main functionality of the system, including the authorisation and ownership of information.

Regarding the aquifer assessment activities, not much has been done on country-based assessment in 2015 because of external project priorities, but in 2016, cooperation with British Geological Survey in Africa and/or the World Bank for their global landing operation may lead to large activities.

Transboundary Aquifers Assessment will remain an important activity of IGRAC in 2016 although the major projects TWAP, DIKTAS and GGRETA are rounded off in 2015. While preparations for a new DIKTAS and GGRETA phase are on-going and led by UNESCO-IHP, IGRAC is also intensively looking for new opportunities for assessment of transboundary aquifers. IGRAC's assessment methodology and the GGIS applications make IGRAC services attractive for various kinds of regional groundwater assessments as was proven by IWMI's invitation to take part in the RAMOTSWA project.

As a part of thematic assessment, IGRAC and UNESCO-IHP produced a draft Guidelines for Multidisciplinary Assessment of Transboundary Aquifers that was presented at the IAH Congress in Rome in September 2015. In 2016 this guidelines will be finalised. Among other thematic assessments planned for next year are: inclusion of large national aquifers in the global coverage, managing aquifer recharge and water accounting and SIDS (Small Island Developing States). Mr Holzwarth informed the Board that UNESCO-IHE recently received twenty MSc grants from the Ministry of Foreign Affairs for the SIDS related research. Mr Holzwarth suggested that IGRAC should contact Ms Maria Kennedy who is a coordinator for the SIDS at UNESCO-IHE.

Ms Alwayn asked how often the groundwater assessment needs to be done. Mr Kukurić answered that a part of the assessment does not have to be done again because the structure of the aquifer is not changing but the aquifer is a dynamical system and therefore needs to be monitored to assess its state on regular basis. Since there is very little info on change and state of groundwater globally, IGRAC initiated Global Groundwater Monitoring Network (GGMN) several years ago. GGMN is a participative, web-based network of networks, set up to improve quality and accessibility of groundwater monitoring information and to subsequently improve our knowledge on the state of groundwater resources. IGRAC is developing a new GGMN portal investing about 100000€. The development of innovative software is not an easy process but hopefully the new version will be ready in February 2016. In 2015, IGRAC submitted a proposal to USAID together with IMWI about groundwater monitoring training in Pakistan, but the proposal was not honoured. In 2016, IGRAC will conduct two trainings that

we originally planned for this year but postponed due to: a) delay in the software development (trainings were foreseen in Thailand with UNESCO Bangkok office) and b) logistical reasons (Pacific SIDS together with WMO).

Among Knowledge Sharing and Governance activities, the Sustainable Development Goals (SDGs) are receiving special attention. IGRAC is contributing to development of SDG monitoring indicators and is producing position papers. The Netherlands will be one of the SDGs "proof of concept" countries and IGRAC will try to get involved. Further, IGRAC is developing a project proposal to bring more groundwater knowledge in WASH activities. Two on-going projects, GROFuture and FREEWAT were mentioned, together with development of a WMO Water Resources Assessment, ISARM activities, IW-LEARN webinars and a new Erasmus Mundus Programme on Groundwater and Global Change where IGRAC is an associate partner of UNESCO-IHE.

Mr Kukurić reiterated that IGRAC would still like to have an intern from the Ministry on Groundwater and Disaster Risk Management, as agreed at the previous Board meeting. Ms Alwaysn informed the Board that that will not be possible because of regulations at the Ministry, namely trainees are only allowed to work for governmental institutions.

The list of the main events in 2015 was presented and Ms Alwaysn asked about judgement on whether an event was successful for IGRAC or not. Mr Kukurić replied that visibility is a very important criterion and Ms Aureli underlined the importance of presenting the newest developments because then they are becoming a reference for an international community, as it is the case with the map of transboundary aquifers. Some events are simply obligations for IGRAC and UNESCO to attend.

The main publications in 2015 and planned events and publications in 2016 were listed as well. About 8000 copies of various publications were distributed during 2015. Ms Alwaysn asked about transition from hard copies to digital publications (because she is not using paper copies any more). Mr Kukurić replied that all IGRAC publications are available in a digital form but in some parts of world the hard copies are necessary. Mr Holzwarth added that hard copies are also very much needed at events such as WWF or WWW.

In terms of communication, IGRAC made in 2015 substantial progress, also reflected in the social media. New website is developed and bimonthly newsletters were produced, along other means of communication.

Finally the budget projects are presented; the 2015 was a very successful year, although not reflected so much in the projected total result and the reserve condition because of a considerable investment in the GGMN software (100000€). The large, long-term projects carried out for UNESCO were completed in 2015 and that will be reflected in the budget for 2016. Mr Kukurić noted that one or two of these projects might get a second phase and that IGRAC is trying to acquire additional projects. Yet, the presented budget projection for 2016 is rather conservative because there are no guarantees about project continuation or acquisition at the moment. Mr de Schutter asked whether is projected 200000€ from external projects an amount that IGRAC is almost sure to acquire? Mr de Schutter gave an example of organisation similar to IGRAC where the projected budget was split in two columns according to chance of acquisition (>50% and <50% chance). Mr Kukurić replied that IGRAC is not sure about acquisition of the most of projected project budget, having in mind uncertainties of acquisition trajectories. Ms Alwaysn asked how much IGRAC has for sure of project-related budget for next year. Not more than 50000€, coming from IGRAC direct acquisition, Mr Kukurić replied.

Ms Aureli stated that IGRAC is considered as UNESCO by scientists at UNESCO, regarding of the legal status; as such, IGRAC was budgeted in 2014 and 2015 to develop an Information Management System (IMS) with contribution of many national and regional experts in a several large projects. Therefore, the importance and impact of the IMS is much larger than the budget allocated for

IGRAC. Mr Kukurić underlined the words of Ms Aureli and asked to continue discussion on future financing of the centre. (Mr Holzwarth left the meeting at this moment.) Ms Alwayn stated that the Ministry set aside 400000€ for IGRAC per year, for the period of six year. The budget for IGRAC is allocated in the new Partners for Water programme, developed for next six years in cooperation of three ministries in the Netherlands, making up the Interdepartmental Water Cluster (IWC). This will allow IGRAC to extend its network and seize new opportunities. Ms Alwayn invited IGRAC to explain to IWC and RVO (Netherlands Enterprise Agency) what IGRAC can do for Dutch embassies and organisations abroad, especially in relationship with International Water Ambitions programme that will be presented to the Dutch Parliament in January. Mr. Kukurić mentioned that IGRAC has already sent to the Ministry its possible contribution to this programme. Ms Alwayn said that she is very confident that new position of IGRAC in the international programming of the Dutch Government may increase IGRAC's revenue because the water is and remains a hot topic globally. Mr de Schutter gave an example of a Global Water Footprint Network that was presented at the Ministry of Foreign Affairs. Mr Kukurić noted that he would be very happy to present IGRAC since he is looking for an opportunity to do that for a long time.

Ms Aureli reiterated importance of the IMS build in last years for UNESCO and eventually the member states. In terms of project cooperation, Mr Aureli stressed that at this stage UNESCO is negotiating some project activities with donors, but she will be able to say more in April-May next year. But for the Member States is crucial to know that we can continue with development of the database, therefore for UNESCO is renewal of the agreement a priority.

Mr Wellens-Mensah asked for which parts of the world recent projects improved knowledge and what are the parts of the world we need to concentrate in coming period. Mr Kukurić replied that IGRAC conducted global assessment of transboundary aquifers and now is completing the global assessment by including large national aquifers. As far as monitoring is concerned, there are only about 15 countries that publish the monitoring data and IGRAC has some data from about 25 countries. The need for groundwater monitoring data is therefore global, but priority should be put on Africa, parts of Asia and South America. IGRAC is planning workshops in Asia (Thailand) and Pacific in 2016. Ms Alwayn noted that SIDS are important for Ministry of Foreign Affairs, being one of their focal points for 2016. Ms Aureli noted that the Member States requested UNESCO to put more effort in SIDS in coming years. Therefore Ms Aureli suggested that the Netherlands and UNESCO (via IGRAC and IHP) can team up on this issue. That is something that the Netherlands could suggest at the next meeting of the IHP Intergovernmental Council in June. Ms Alwayn advised Mr Kukurić to mention SIDS when he comes to present IGRAC to the IWC.

Mr de Schutter mentioned that Mr Bastiaanssen from UNESCO-IHE might be a good representative of UNESCO-IHE to the IGRAC Governing Board. Mr Kukurić replied that UNESCO-IHE was represented by a managing director and that he expects a similar representation in the future. At the same time, IGRAC already has on-going meetings with Mr Bastiaanssen looking for an opportunity to join the forces.

Adoption of previously sent documents

Ms Alwayn noted that Ms Aureli is mentioned twice as Mr Aureli in the Minutes from the last Governing Board meeting held in December 2014. She also noted that "permanent position" should be replaced by "preferred partner" on the page 4, when describing a new funding from the Netherlands to the World Bank. Mr Kukurić will implement the suggested changes. Since other members of the Governing Board had no remarks on the draft Minutes neither on IGRAC Report 2014, the both documents were then adopted.

Ms Alwayn asked about IGRAC visits to WMO and UNESCO and the common statement of WMO and UNESCO to the WMO congress. Mr Kukurić informed that he had meetings at WMO with the Secretary General and at UNESCO with the ADG Natural Sciences. Mr Wellens-Mensah stated that the meeting at WMO had a spin-off in agreeing with IGRAC to organise a joint training on groundwater monitoring for Pacific Islands on Fiji next year. WMO is very interested to engage IGRAC in monitoring activities in the IGAD region, where WMO already has a monitoring programme, and later in other regions. Mr Wellens-Mensah also mentioned that a new director of Water and Climate department at WMO, Dr Johannes Cullmann, is very supportive of collaboration with IGRAC and wanted to attend this meeting. Finally, Mr Wellens-Mensah noted that IGRAC was mentioned - together with other three WMO data centra - in the documentation of the 17th session of WMO Congress held this year.

Mr Kukurić noted that he would still appreciate if UNESCO and WMO would prepare a kind of joint statement. The board members supported this and the joint statement therefore remains as an action point.

Future of the centre

Ms Aureli informed the Governing Board about development of SDG monitoring activities and stressed that only a few parties recognise high importance of transboundary waters. Ms Alwayn underlined this importance and promised to support it as much as the Netherlands, as one country among many, can do. That would be very much appreciated – Mr Kukurić noted - since the transboundary water indicator has recently removed from the SDG indicator list.

Referring back to the item of the agenda, Ms Alwayn noted that the Ministry sent a letter to UNESCO about the willingness to renew the agreement and received a reply from UNESCO. Ms Aureli said that the renewal is opportunity to elaborate on issues that are important for the good functioning of the centre. The future of the centre was already discussed several times with the Netherlands Delegation at UNESCO and IGRAC. UNESCO Members States require database - Ms Aureli noted - that will give a regional and global overview of state of groundwater resources with respect to any impacts (basically climate change and human activities) and associated risks.

Ms Aureli noted that the only water-related database where data are consistently supplied by member states is AQUASTAT at FAO. We should strive to make the same or similar arrangement for the UNESCO database at IGRAC. The first step would be to agree on a necessary set of data to be requested from the member states and to submit this to the IHP Council for approval. This needs to be a fully intergovernmental process because some countries still consider groundwater as a strategic source. Because of this sensitivity the database needs to be clearly a UN database, where the countries (data providers) should decide on data sharing and dissemination.

UNESCO is investing in this database at IGRAC because scientifically, technically and practically IGRAC is UNESCO. However, for the UNESCO administration, IGRAC is not UNESCO and the contracting IGRAC is same as contracting of external partners. Therefore, Ms Aureli pointed out, renewal of the agreement should be taken as an opportunity to talk with the IOS and the Legal Affairs at UNESCO in order to find a solution for this problem.

Mr Kukurić noted that to his opinion the best option would be that of IGRAC becoming legally UNESCO (i.e. Category I Centre). Ms Aureli said that at this moment various options should be explored and probably there are several mid- and long term solutions. We should concentrate at agreement renewal and in meantime the collaboration in projects and programmes can continue without interruption. Ms Aureli stated that the intention is to renew the agreement for the category II centre, probably with some minor changes. Since both parties (UNESCO and the Dutch Government) expressed interest to renew the

agreement, the Ministry can make decision to continue funding IGRAC. Mr Kukurić asked what the Ministry still needs from IGRAC or UNESCO to execute this decision and release the grant for 2016. Ms Alwayn asked then UNESCO about the remaining steps required for the renewal. Ms Aureli replied that the agreement is reviewed at the moment to be aligned with the 2013 version of rules and regulations for category 2 institutes and centres under auspices of UNESCO. Ms Aureli asked Mr Kukurić to distribute this document to the Governing Board members. As soon as the agreement is reviewed and adjusted it will be sent to the Ministry. Ms Alice said that she is not expecting any major revision but it has to be checked with the legal affairs. Ms Aureli said that this is an opportunity for the Ministry and UNESCO to improve and expand the agreement according to preferences of both parties. Ms Aureli suggested that UNESCO and the Ministry should sit together and bilaterally discuss the new agreement. Ms Alwayn agreed with this. The meeting can be organised in February 2016 when the evaluation of the centre is also completed.

The evaluation of the centre will start in January and has to be completed before 10th of February. UNESCO received three CVs for an external evaluator and already selected the most suitable candidate. The questionnaire is prepared and sent to main UNESCO IHP regional offices, IGRAC partners, international institutions related to groundwater. Mr Kukurić noted that the evaluator will come to the Netherlands as well and he would like to have an interview with the representatives of the Ministry and the Foundation Board. Ms Aureli reiterated that the evaluation should assist in making arrangements with UNESCO administration that would improve cooperation, clarify status of the database and simplify contracting with IGRAC.

Mr de Schutter asked the evaluation report to be sent officially to the IGRAC Foundation Board. Ms Aureli replied that the report will be sent to the Permanent Delegation of the Netherlands to UNESCO, to be distributed further to the Ministry, to the Director of the centre, the Foundation Board and other stakeholders.

According to Ms Aureli, the renewed agreement will be submitted for the approval to the Executive Board in April so that it can come in force in August 2016. Mr Kukurić asked whether that can be done earlier, because it is important for IGRAC to renew the agreement as soon as possible, also because of the financing from the ministry. Ms Aureli said that the August is deadline, but it can be done earlier, probably already in May. Ms Alwayn said that the Ministry will continue financing IGRAC, of course if the evaluation of the centre is positive.

Mr. Wellens-Mensah asked about the legal status of the database at IGRAC, which is a common patrimony, whether this will be included in the agreement or not. We have to consider how to address this, Ms Aureli replied, the legal affairs from the both side need to look at it. Mr Kukurić pointed out that if a separate agreement is made, it should be with IGRAC and not with the Ministry. Ms Aureli said that even if most of the data collected are collected by UNESCO projects is premature to elaborate on options, it should be done in consultation with the legal affairs.

Mr. Wellens-Mensah asked whether UNESCO intends to pass a new resolution on data sharing; since WMO already has a similar resolution which will be then reinforced by the UNESCO resolution. Ms Aureli stated this will be rather technical/scientific resolution based on analysis of the an expert group on what kind of groundwater data/information Member States can provide to UNESCO on regular basis, similar as it is done with AQUASTAT database at FAO. This will also be of high importance for estimation and monitoring of SDGs.

Ms Alwayn asked Mr. Filali Meknassi to introduce himself. Mr. Filali Meknassi informed the Governing Board that he is at UNESCO for about nine years, working, among other places, in Rabat, Windhoek and from January 2016 in Paris in the IHP Secretariat.

Any other business

None.

Conclusions and agreements

- UNESCO and the Ministry exchanged the letters expressing intention to renew the agreement on IGRAC.
- UNESCO is preparing a concept of the renewed agreement that will be sent to the Permanent Delegation of the Netherlands to UNESCO not later than 10th of February.
- UNESCO is preparing an evaluation of IGRAC. The Ministry and the Foundation Board will be approached for an interview with the external evaluator. The evaluation report will be sent to the Permanent Delegation of the Netherlands to UNESCO not later than 10th of February.
- UNESCO and the Ministry will meet in February to discuss the evaluation report and finalise the renewed agreement.
- The renewed agreement will be submitted to the UNESCO Executive Board in April 2016 for approval.
- The renewed agreement needs to be signed before August but the both parties will strive to do it earlier.
- The Ministry expressed intention to continue core-financing of IGRAC for the following six year with 400.000€ p/a. The Ministry will continue the core-financing already for 2016, provided that evaluation report is positive.
- IGRAC will make presentation to the Interdepartmental Water Cluster on possible contribution to International Water Ambitions programme.
- IGRAC will contact Ms Maria Kennedy who is a coordinator for the SIDS at UNESCO-IHE to discuss possibilities for cooperation.
- Document (2013) describing strategy for category 2 institutes and centres under auspices of UNESCO will be distributed to the members of the Governing Board.
- UNESCO and The Netherlands will explore opportunity to team up on SIDS activities for a next meeting of the IHP Intergovernmental Council in June 2016.
- UNESCO and WMO will continue effort to find an opportunity to issue a joint statement on groundwater/monitoring/IGRAC.
- ...

Closing the meeting

Meeting of the Governing Board was closed by the chair Ms. Alwayn at 12.20.

