

# African Experience on Groundwater Management: Context of the Network of the African Centres of Excellence on Water (ACEWater2)

EU-China Workshop on Water: Policy, Science and  
Technology

Venue: Joint Research Centre, Ispra, Italy  
05-07 December 2016

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CSIR, Natural Resources & Environment  
Water Resources Competence Area

**CSIR**  
*our future through science*

# Presentation Structure

- **African Groundwater Context and Current Situation**
- **Network of the African Centres of Excellence (ACEWater2): Recent Events**
- **In Closing ...**



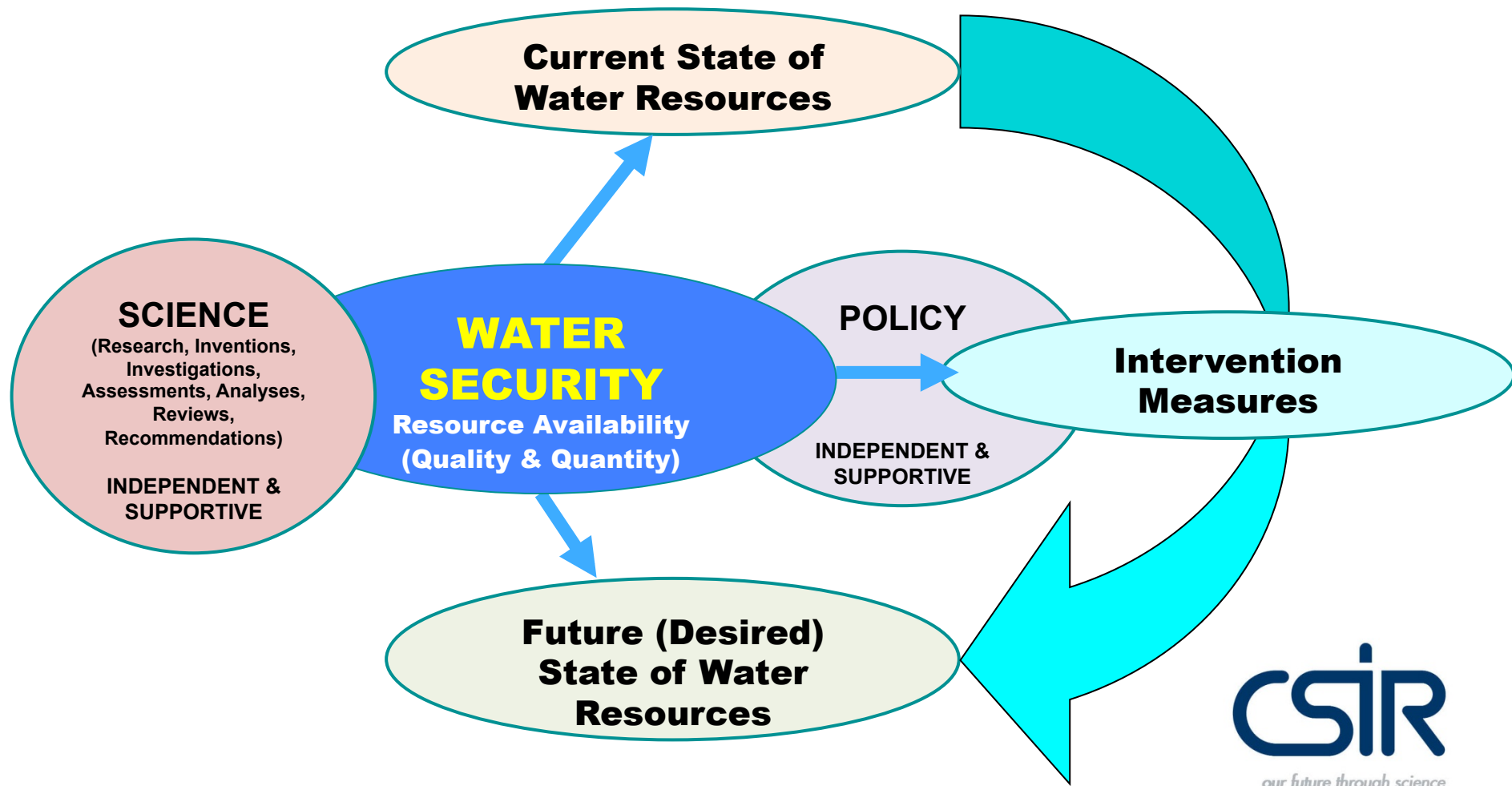
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# Africa Groundwater Context & Current Situation

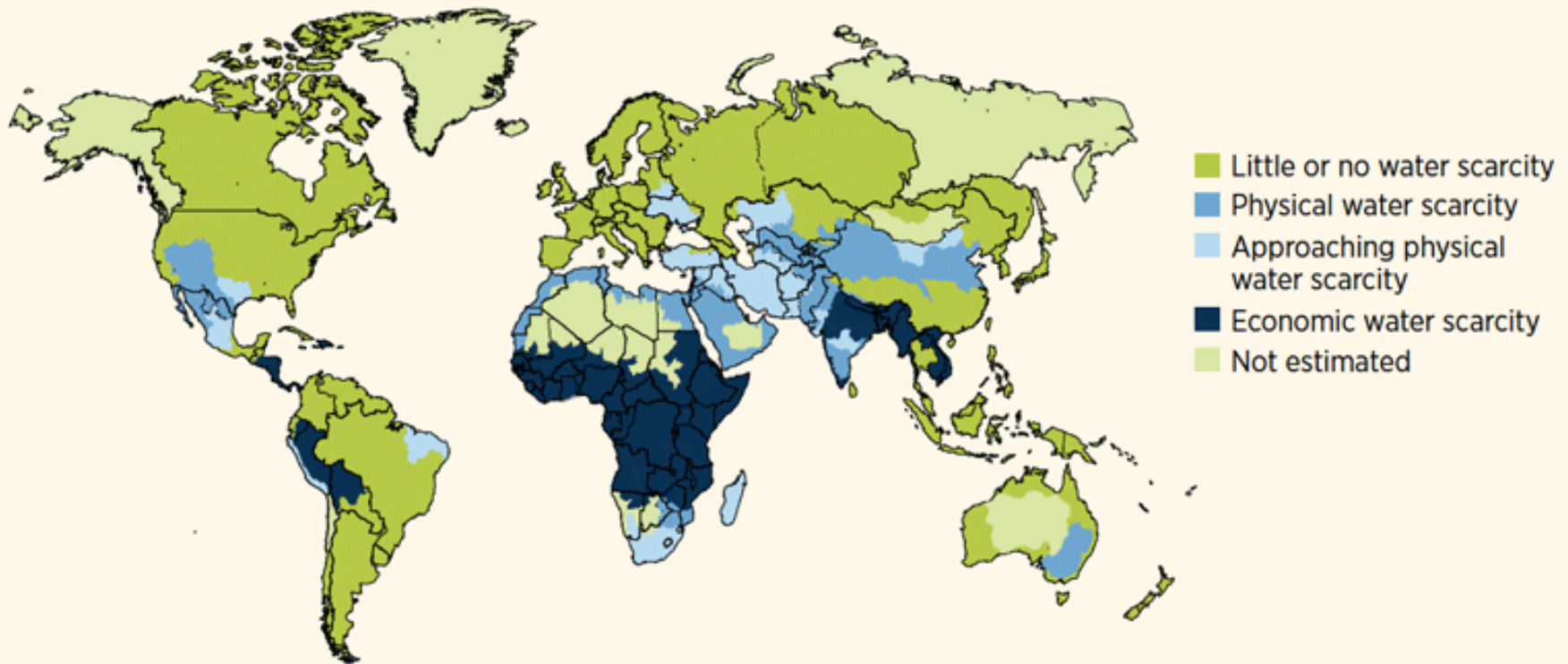
# Relationships Among Water Sector Drivers

## The Science (SET), Socio-Economic Development & Politics Interface



# WATER SCARCITY GLOBAL ASSESSMENT

Global physical and economic water scarcity



# WORLD ECONOMIC FORUM

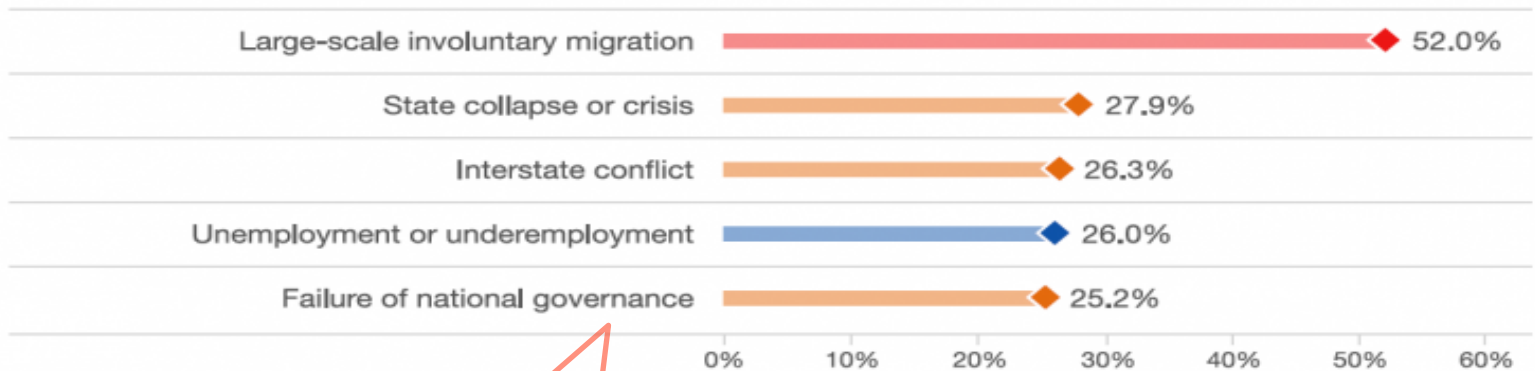
## ... Global Risks 2016 ...



### The Global Risks of Highest Concern, 2016

Percent of participants mentioning the respective risk to be of high concern for the time frame of 18 months or 10 years, respectively. Participants could name up to five risks in each time frame. In each category, the risks are sorted by the total sum of mentions.

#### For the next 18 months

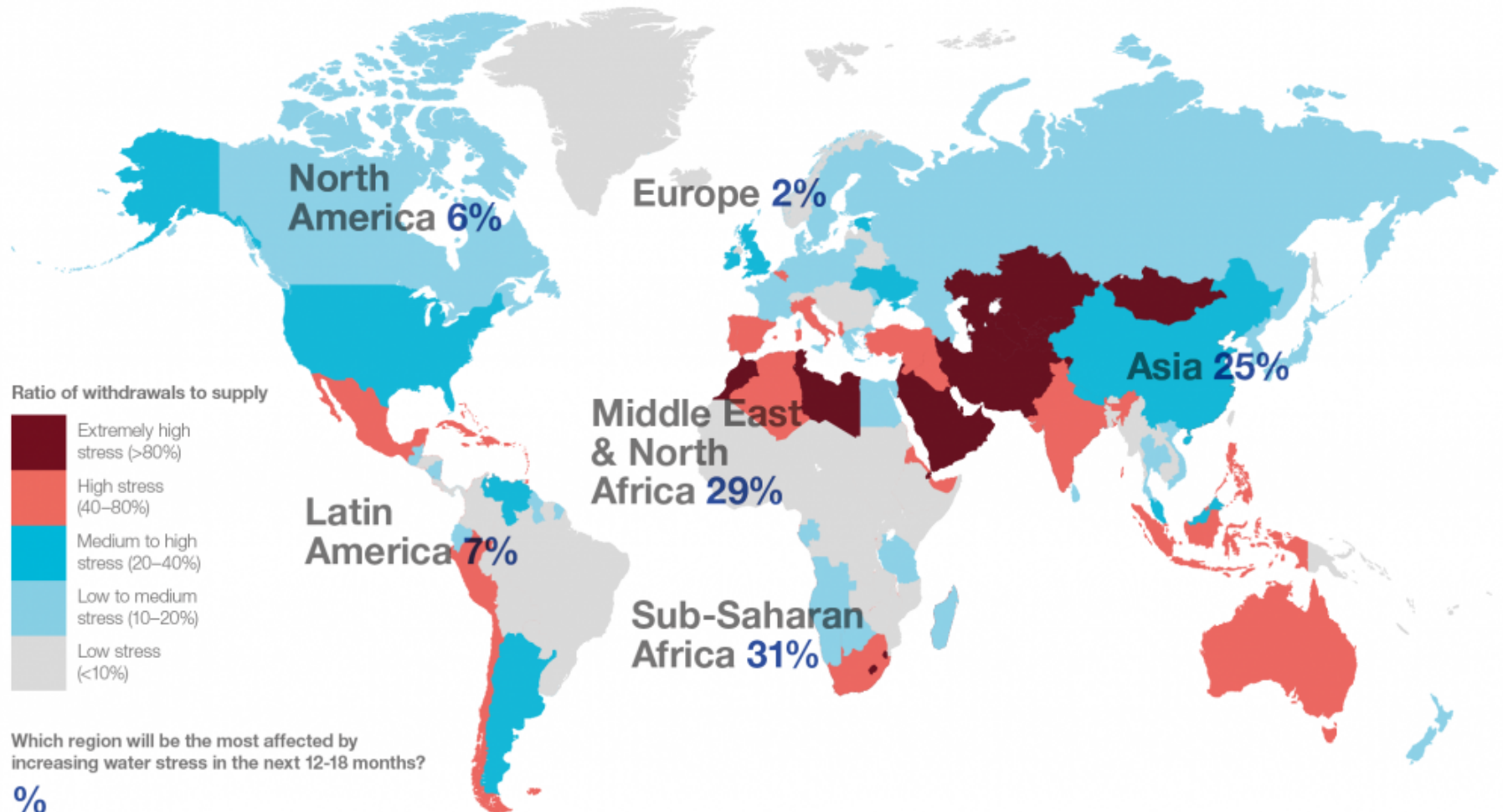


#### For the next 10 years



Read more: [wef.ch/risks2016](http://wef.ch/risks2016) #risks2016

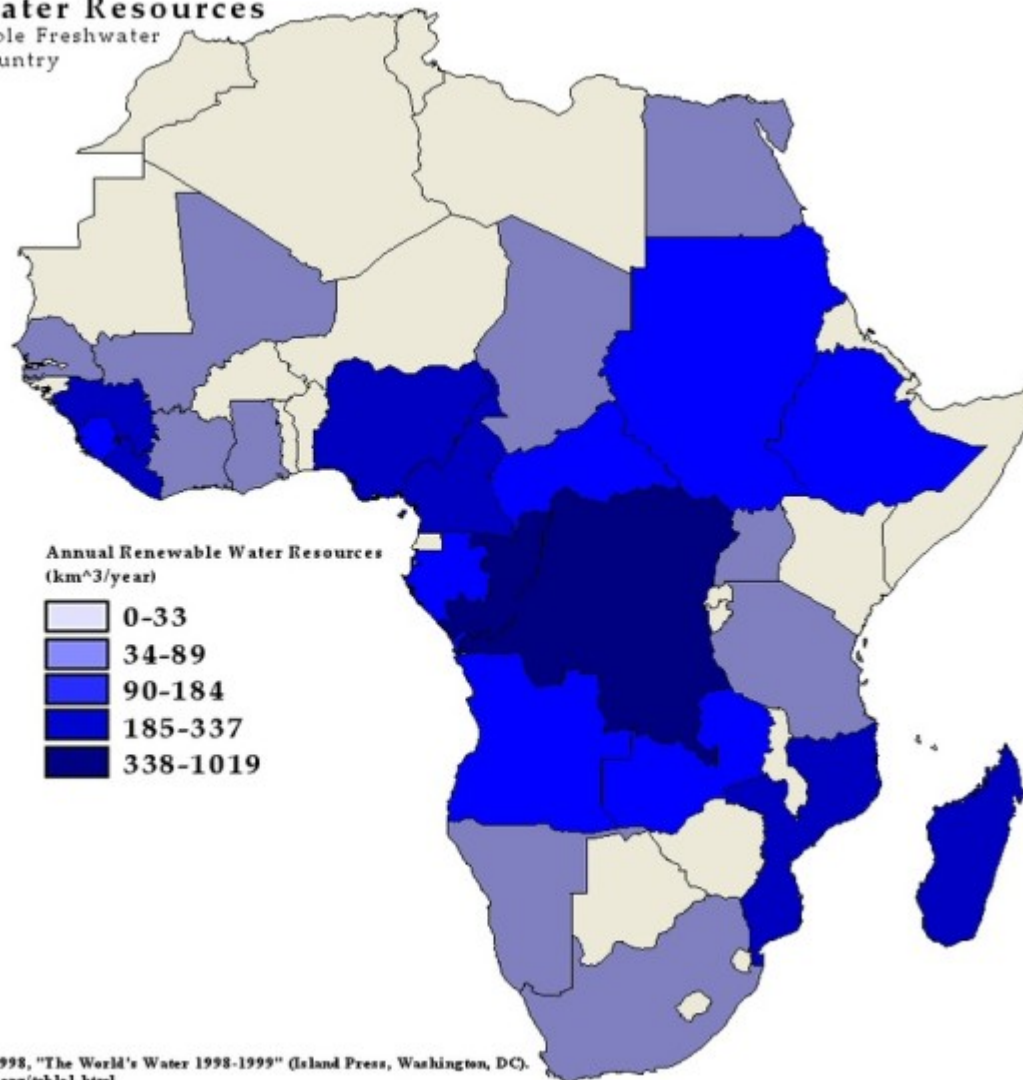
# WATER STRESS – 12 to 18 months



# AFRICA'S WATER AVAILABILITY

## Africa Water Resources

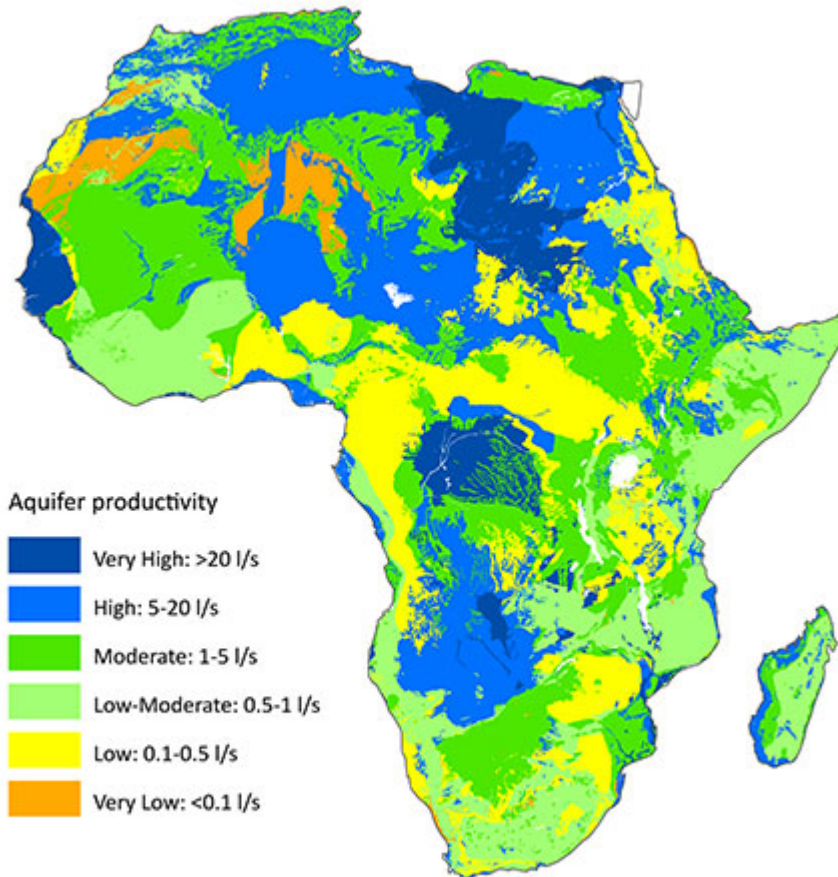
Total Renewable Freshwater  
Supply By Country



Source: P.H. Gleick, 1998, "The World's Water 1998-1999" (Island Press, Washington, DC).  
<http://www.worldwater.org/table1.html>

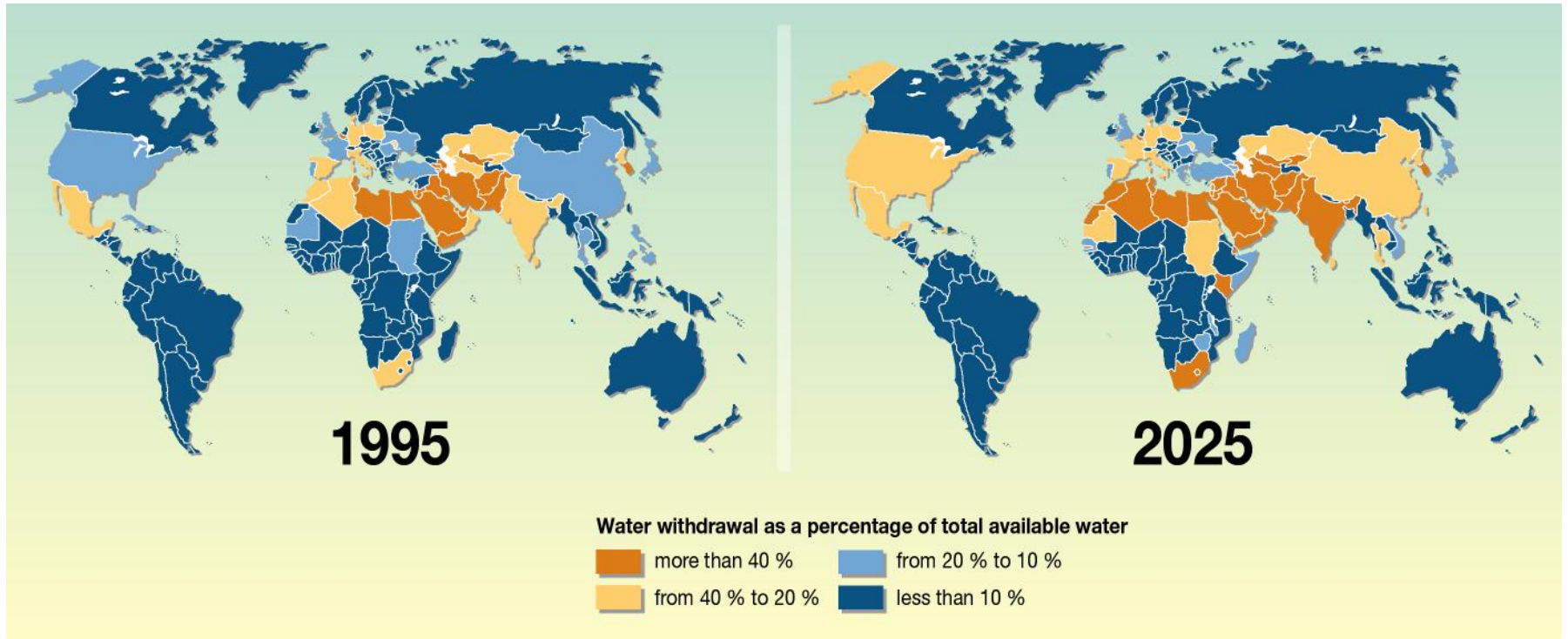


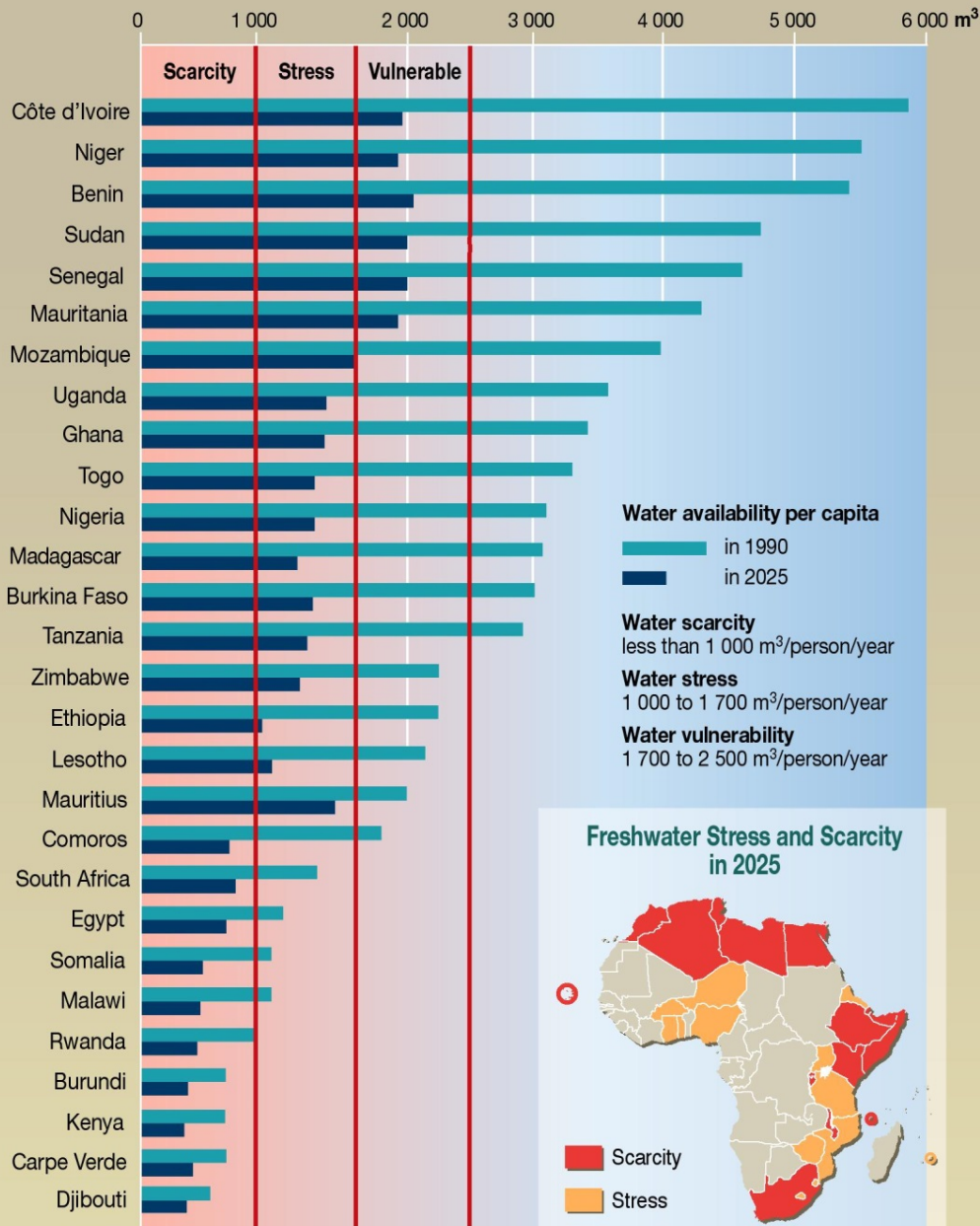
# GROUNDWATER RESOURCES



British Geological Survey © NERC 2011. All rights reserved.  
Boundaries of surficial geology of Africa, courtesy of the U.S. Geological Survey.  
Country boundaries sourced from ArcWorld © 1995-2011 ESRI. All rights Reserved

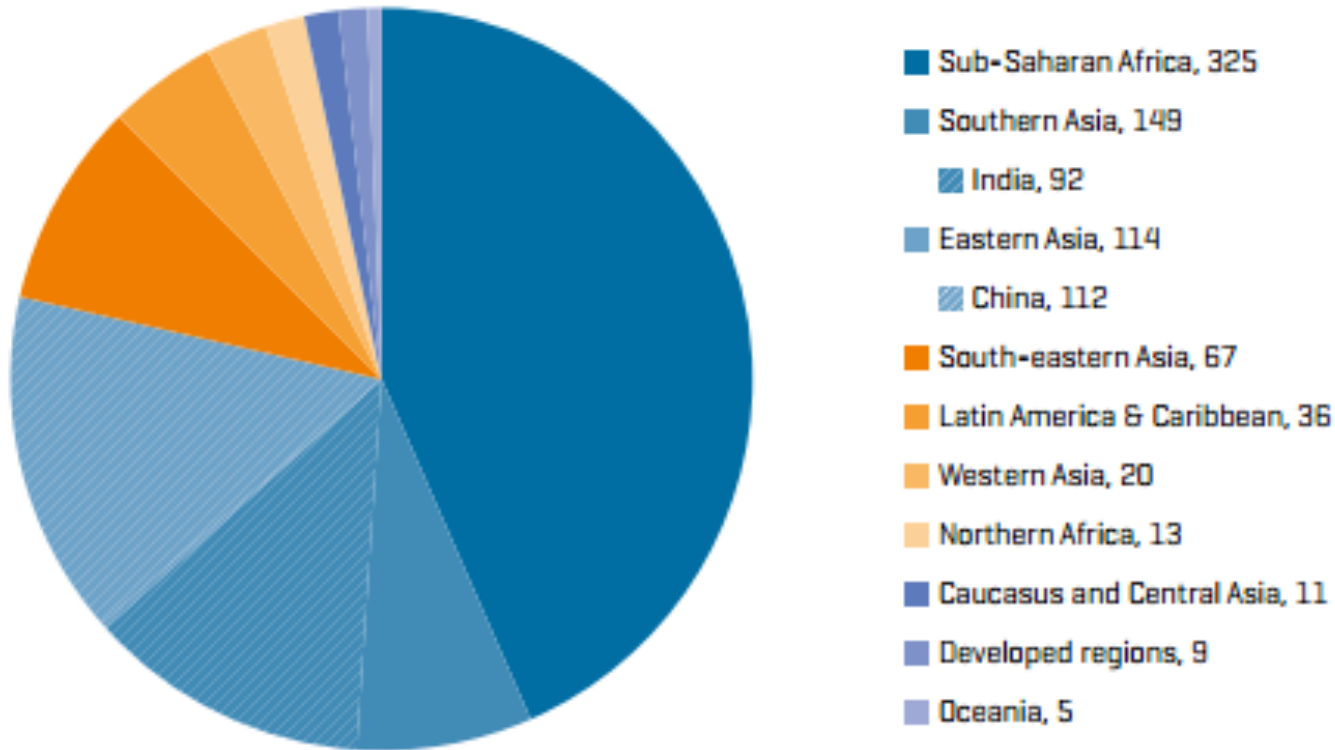
# DEMAND PROJECTIONS





# ACCESS TO WATER & SANITATION - GLOBAL

**Two out of five people without access to an improved drinking water source live in Africa**



# 300 million people in Africa don't have access to clean water

Tuesday 25 August 2015 18:32

Aldrin Sampear



About 300 million people in Africa don't have access to clean water and close to half a billion don't have access to sanitation.(SABC)

## Tags:

- [Sweden](#)
- [Africa](#)
- [World Health Organisation](#)
- [World water week](#)
- [Development goals](#)
- [Aldrin Sampear](#)

Financing water and sanitation infrastructure in Africa has come under sharp focus at the World Water Week in Sweden.

The World Health Organisation (WHO) says budgets are either low, or disproportionate. This as several states committed themselves to meeting targets set out in the maintainable development goals.

About 300 million people in Africa still don't have access to clean water and close to half a billion don't have access to sanitation. The blame lies directly on the continent's weak finances.

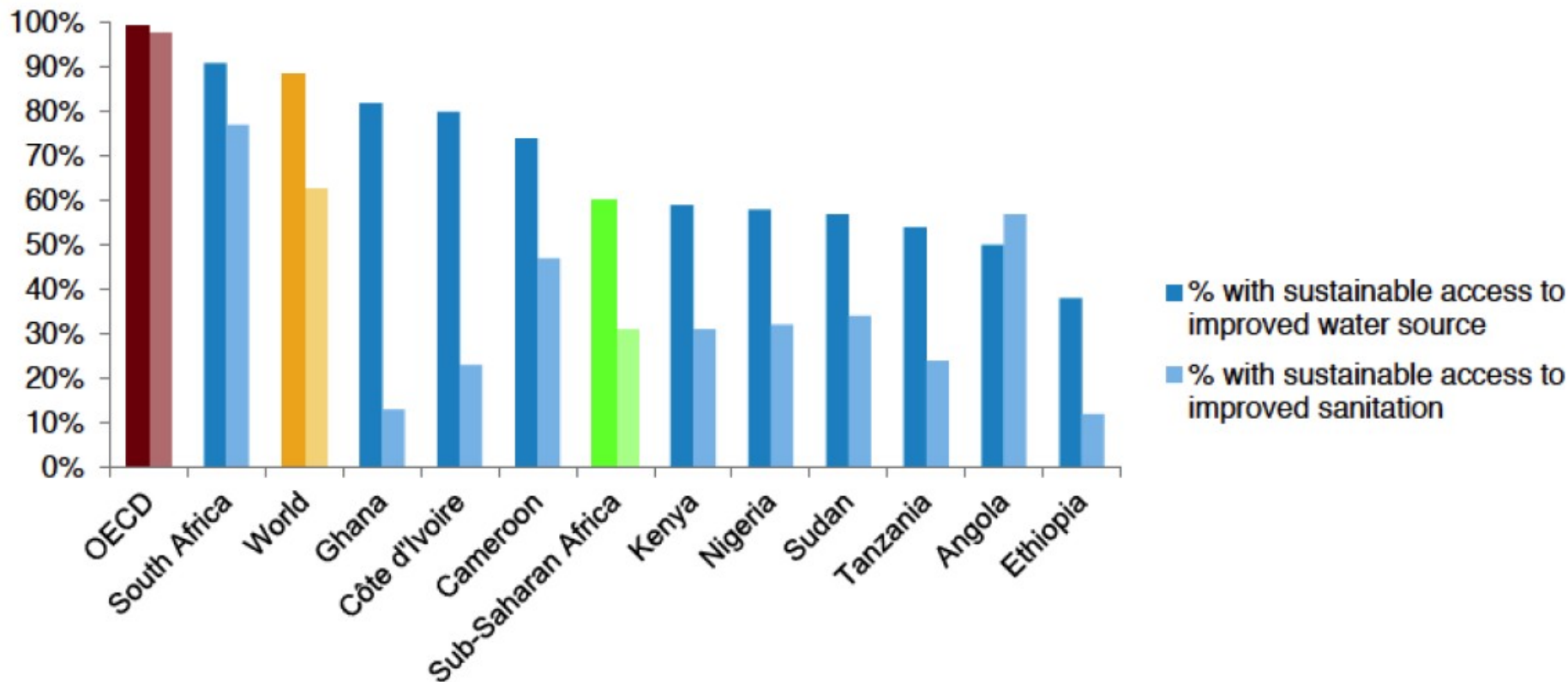
Experts say the reliance on foreign aid to fast track water and sanitation infrastructure comes as no surprise. However, the WHO says some strides were made between 2013 and 2014.

South Africa is ranked among the biggest spenders on Water and Sanitation. At nearly \$4billion, the budget is six times more than Nigeria spends.

The WHO also highlighted lack of water and sanitation policies slowing down infrastructure roll out.

# ACCESS TO WATER & SANITATION - AFRICA

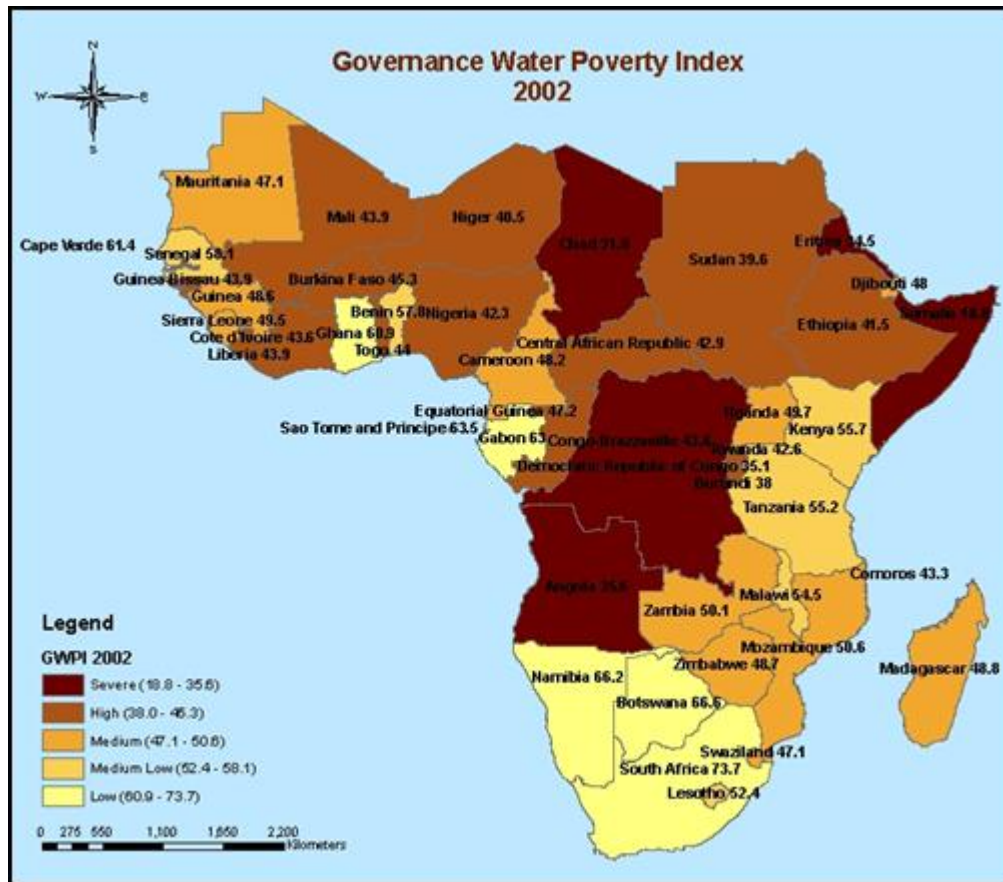
Population access to water and sanitation (2010)



# SHARED WATERCOURSES



# AFRICA WATER GOVERNANCE





**Table 1.6 Evolution of Water Supply Coverage in Africa, by Source (percent)**

Period	Piped supply		Standposts		Well and boreholes		Surface water	
	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural
1990–95	50	4	29	9	20	41	6	50
1995–2000	43	4	25	9	21	41	5	41
2001–05	39	4	24	11	24	43	7	42

Source: Banerjee, Wodon, and others 2008.

standposts saw a similar decline, but that of boreholes rose, so that each represented about 24 percent of the urban population in 2005. Overall, about two-thirds of the urban populace depends on utility water. The lower coverage of standposts compared with piped water is particularly striking, given the relatively low cost of standposts and the pressure to expand services rapidly. Reliance on surface water, at 7 percent of the urban population, changed little between 1990 and 2005.

Utilities are the central actors responsible for water supply in urban areas. In the middle-income countries they are essentially the only players, reaching about 98 percent of the urban population, the vast majority through private piped-water connections. In low-income countries only 68 percent of urban residents benefit from utility water, fewer than half through private piped connections (table 1.7). For the rest, informal sharing of connections through resale between neighbors (15 percent of the urban population) is almost as prevalent as formal sharing through standposts (19 percent of the urban population).

Utilities report providing about 20 hours per day of service (table 1.8). They typically produce just more than 200 liters per customer served, though the amount for middle-income countries is about twice that for low-income countries. If the total water production of the utilities could

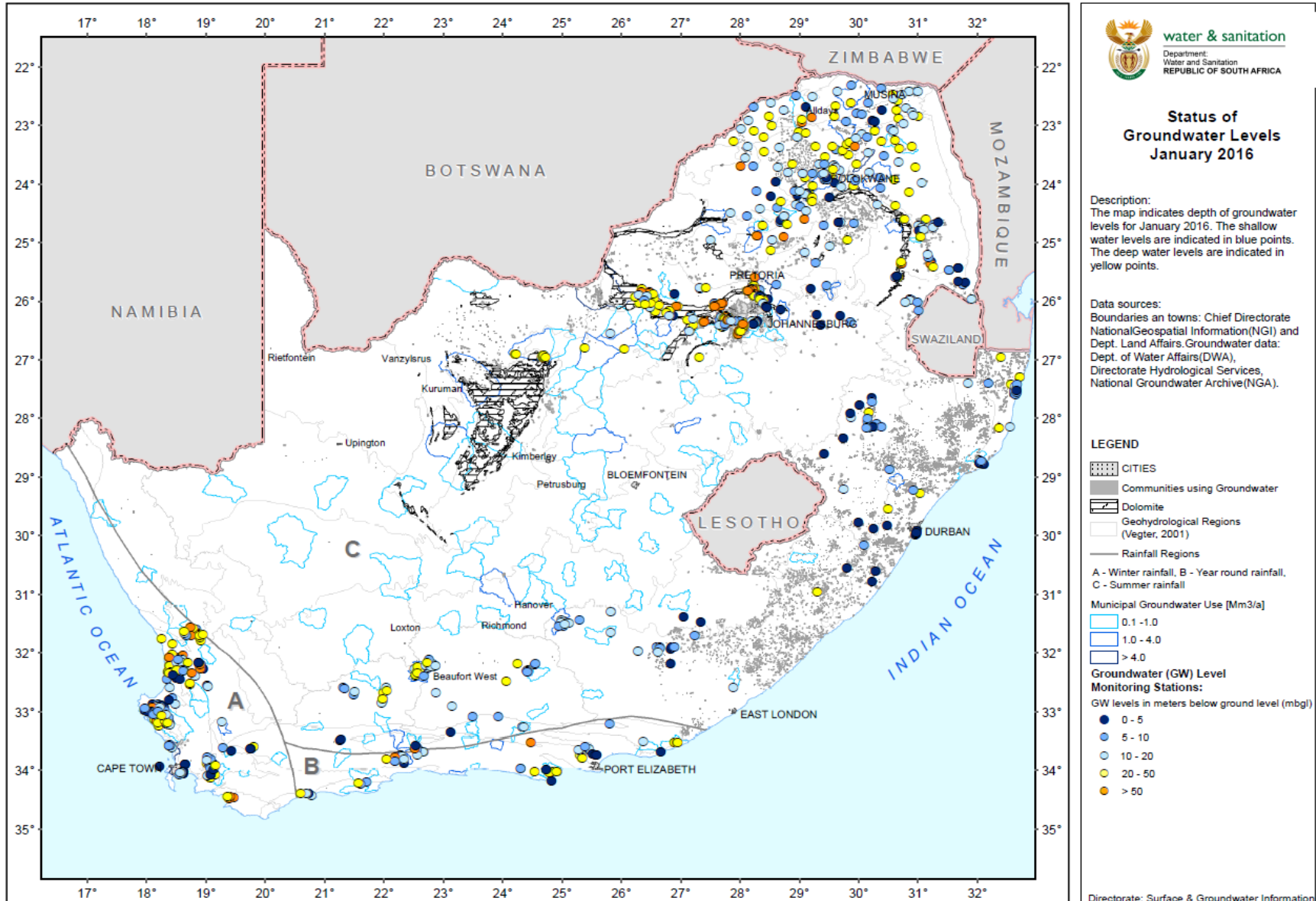
### Key Finding 5: Institutional Reform for Better Water Sector Performance

Many African governments have reformed their WSS systems in the past two decades to provide better services for their citizens. Countries that have pursued institutional reforms have built more efficient and effective sector institutions and achieved faster expansion of higher quality services. The potential dividend of such efforts is large, because addressing utility inefficiencies alone could make a substantial contribution to closing the sector funding gap in many countries. Utilities that have decentralized their WSS services or adopted private sector management have done a better job of eliminating inefficiencies and other hidden costs than those that have not. Unbundling of services can also be beneficial, but unbundling is rare in Africa and exclusively concentrated in middle-income countries, whose superior performance can be explained for many other reasons. At the same time, higher levels of regulation and better governance of utilities (often accompanied by corporatization) are associated with lower efficiency (figure 1.8).

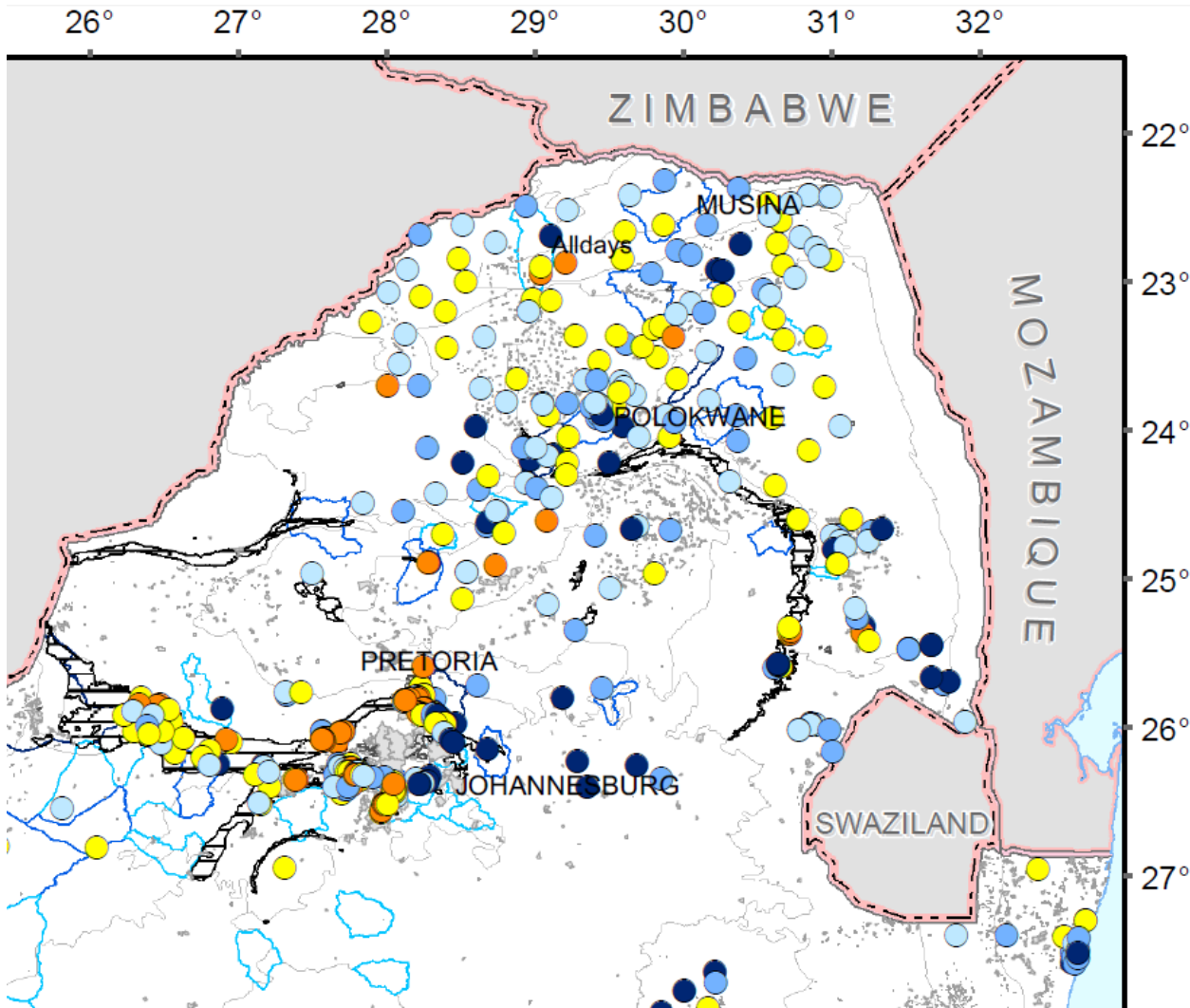
The reform agenda has had two major thrusts: increasing private participation and improving governance from within.

Private sector participation has helped to improve utility performance, with Senegal being particularly noteworthy. Management contracts awarded to private operating companies, being relatively short-term instruments, have had a material effect on improving revenue collection and service continuity, but they have not had much of an impact on more intractable issues, such as reducing unaccounted-for water and expanding access. Lease contracts have drastically improved access and boosted operational efficiency, but, except in Côte d'Ivoire, the associated investments

# SA Groundwater Status: January 2016



# SA Groundwater Status: January 2016 DETAIL



water & sanitation

Department:  
Water and Sanitation  
REPUBLIC OF SOUTH AFRICA

## Status of Groundwater Levels January 2016

### Description:

The map indicates depth of groundwater levels for January 2016. The shallow water levels are indicated in blue points. The deep water levels are indicated in yellow points.

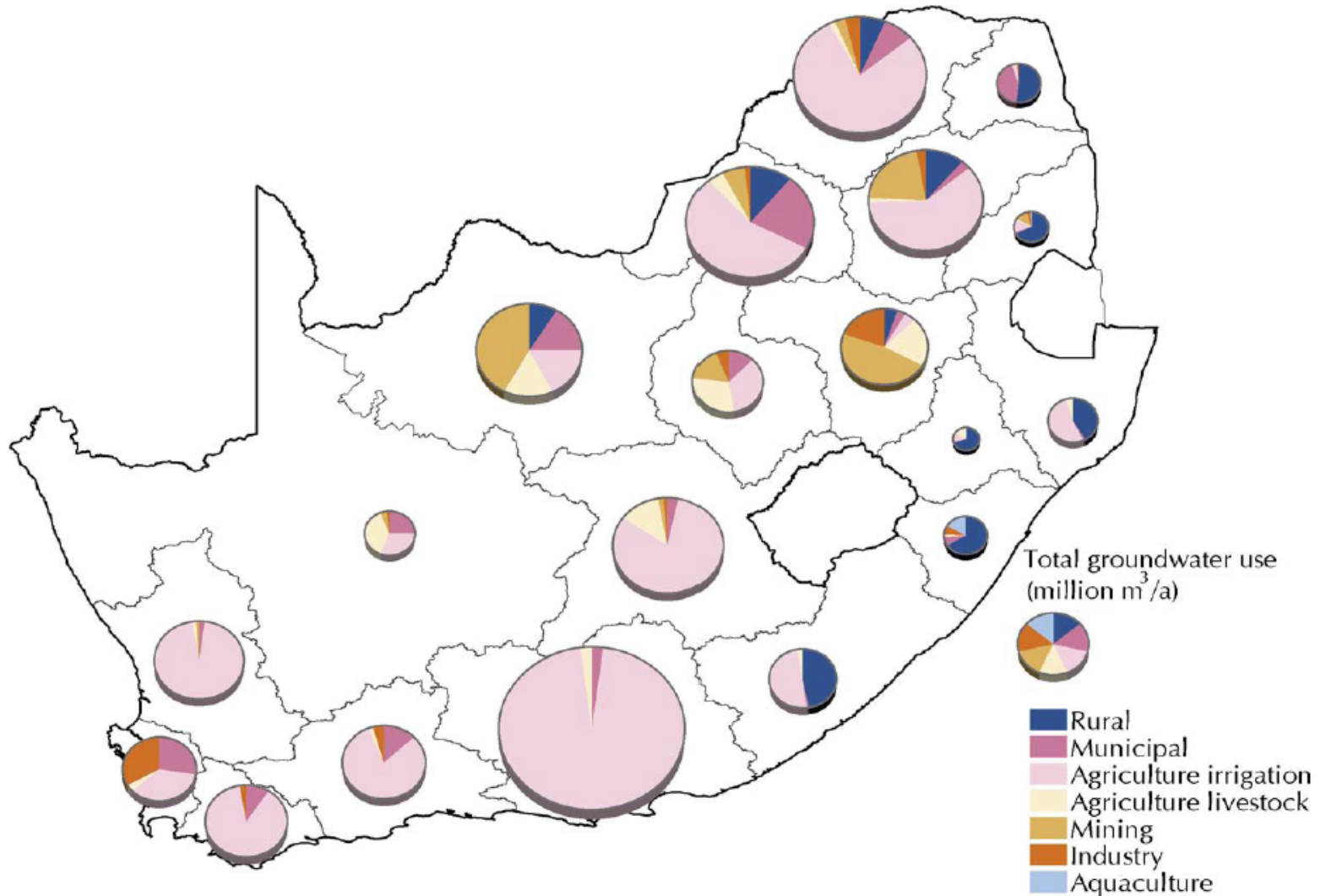
### Data sources:

Boundaries and towns: Chief Directorate National Geospatial Information (NGI) and Dept. Land Affairs. Groundwater data: Dept. of Water Affairs (DWA), Directorate Hydrological Services, National Groundwater Archive (NGA).

# SA Groundwater Use per Sector: 2010

<sup>ii</sup> Estimated use from existing boreholes and springs. Total groundwater use may exceed this estimate as a result of development of groundwater for irrigation since the compilation of the database for the NWRS. Increase is due mainly to growth in irrigation water requirements, and therefore does not impact significantly on the overall water balances given in the NWRS.

Map 3: Sectoral groundwater use (million m<sup>3</sup>/annum) per water management area<sup>5</sup>



# Current SA Drought since 2014.....

## Groundwater an option to current water crisis

**Pretoria** - South Africans must consider using groundwater on a grand scale to augment the fast diminishing surface water, says Director General of the Department of Water and Sanitation, Margaret-Ann Diedricks.

Speaking at a conference of the Water Resources Group (WRG) on Thursday, Diedricks said there was an overreliance on surface water at the expense of groundwater that could play a pivotal role to alleviate South Africa's water woes.

The five-day conference is held under theme '2030 WRG Knowledge Exchange' to develop partnerships that can assist governments to accelerate actions and increase water sustainability and efficiency.

It also raises awareness about water scarcity challenges and to find possible solutions among high level decision-makers, as well as to support in-country activities.

Diedricks told delegates from East Africa, India, Mongolia, Bangladesh, Peru and Mexico that South Africa, together with its neighbours, is experiencing the difficulties of climate change through the drought that has destroyed crops and livestock in its wake since 2014.

## ClimDev-Africa Policy Brief

### Management of Groundwater in Africa: Implications for Meeting MDGs, Livelihood Goals and Adaptation to Climate Change

*Groundwater is one of the most important sources for drinking water, livestock water and irrigation in Africa. It is particularly important for arid and semi-arid countries in the northern and southern parts of Africa, since it is often the only source of water in these areas. Groundwater resources represent 15% of the continent's renewable water resources, yet its hidden presence under the ground has left it largely under-valued and under-utilised, with the exception of its use for potable water. While the availability of rainwater and freshwater from rivers and lakes will likely become more erratic and thus less reliable as a result of climate change, groundwater is likely to be less affected than surface resources by climate variability, higher temperatures, and evaporation.*

# ClimDev-Africa Policy Brief 5 - ACPC, 2013

## Needs and recommendations

There is a growing recognition that groundwater management in Africa can be an essential component of climate change adaptation strategies.

Renewable groundwater resources in Africa are underutilised, yet groundwater can play a major role in assisting farmers to increase food production and to overcome threats to food security if climate change leads to greater rainfall variability.

The following are some recommended actions for overcoming obstacles to groundwater development:

- Research is needed on how to overcome the high cost of well construction and the limited understanding of groundwater resources, which currently restrict development of groundwater for irrigation in many parts of Africa. At present, less than 1% of the area under cultivation is irrigated by groundwater in sub-Saharan Africa.

- An improved understanding is needed of the role of groundwater in sustaining the environment and supporting ecological services.
- More quantitative information regarding groundwater flow and storage is needed. Understanding the flow and storage properties of groundwater in various aquifer systems is key to their sustainable development and management. For example, the current understanding of the weathered- and fractured-bedrock aquifers is simplistic and largely conceptual. Specific knowledge gaps include circulation rates in aquifer systems and the response of aquifer systems to intensive abstraction.

## Key messages

- Groundwater represents a vast untapped source of water in Africa, but technical, socio-economic, and institutional factors, have constrained its use.
- Groundwater management in Africa can be an essential component of climate change adaptation strategies.
- However, important gaps in knowledge of groundwater resources exist in Africa that must be narrowed if groundwater is to play a major role in assisting adaptation to climate change.



# CGIAR & IWMI – K Villholth, April 2016

**Currently, groundwater is a largely untapped resource in sub-Saharan Africa, with only 1% of cultivated land being equipped for groundwater irrigation in all of Africa, as compared to 14% in Asia.** There are sufficient groundwater stores in many parts of the continent, so the potential to increase use for irrigation is quite high.

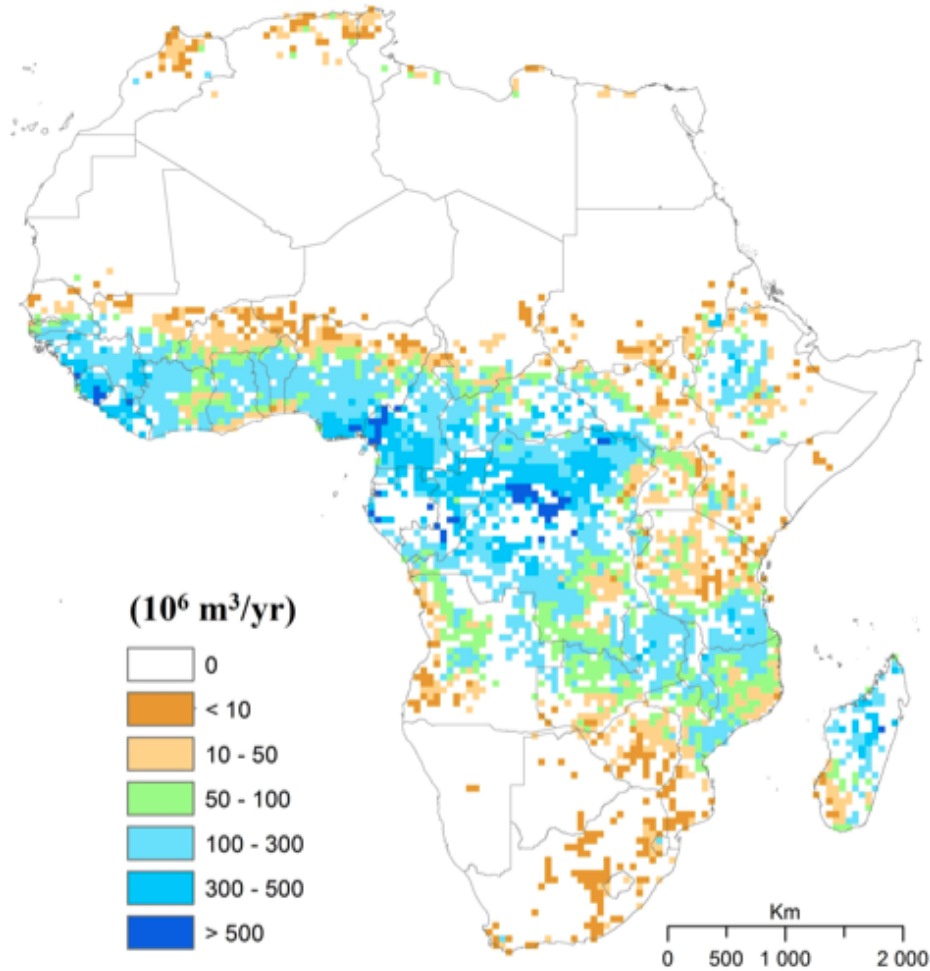
New maps produced by the International Water Management Institute (IWMI) show the irrigation potential of areas that have renewable groundwater resources. **They show crop water demand, as well as availability of renewable groundwater and consider not only the demand for water for irrigation, but also for other human uses and the environment.** The maps show that this demand can be met solely through groundwater use.

Researchers were able to determine that, with 70% of the recharge going back to the environment, the **area irrigated by groundwater in Sub Saharan Africa had the potential to increase by a factor of 20, from approximately 2 million to 40 million ha.**

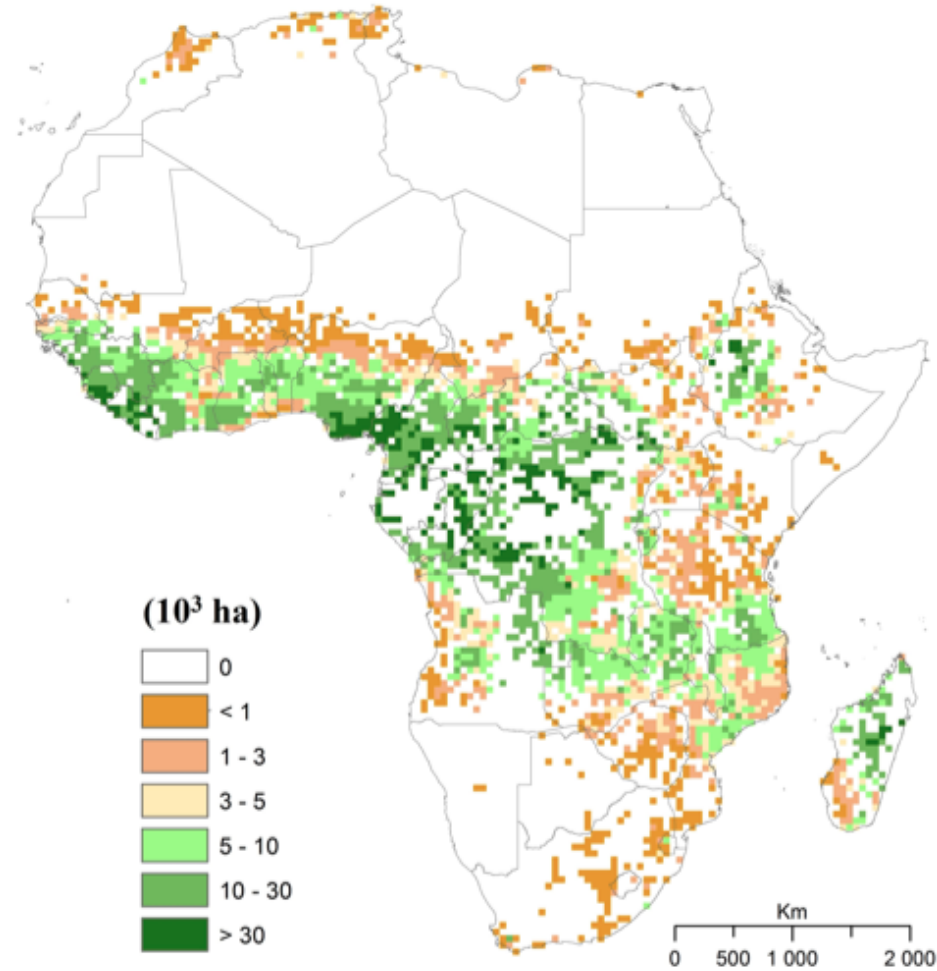
# Groundwater Availability & Irrigation Potential


(CGIAR & IWMI)

## Groundwater availability for irrigation



## GWIP





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**Network of the African  
Centres of Excellence  
(ACEWater II):  
Recent Events**

# NEPAD Networks of Centre of Excellence in Water Sciences PHASE II

This project, requested by the African Ministers of Water to DG DEVCO, **aims at supporting the establishment of Human Capacity Development Programme of the AMCOW in the Water Sector, strengthens institutional networking and improving research support to policy making by scaling up the approach of the pilot phase (Phase I).**

The project is implemented under the coordination of the JRC and the support of UNESCO that implements the Human Capacity activities. **The Commission Decision was signed in August 2015 and the implementation of the project started in January 2016.**

**In May 2016, the Kick-Off meeting was held in Cape Town (South Africa),** where the project's outlines, including objectives, activities, expected results and tentative working plan were shared among project partners and stakeholders (including RECs and Institutions).

# GWP SA Report – 27 May 2016

• Visit Global Water Partnership International website



**GWP Southern Africa**  
*Towards a water secure world*

English

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ABOUT THE CHALLENGE **GWP SA IN ACTION** GET INVOLVED LIBRARY Country Water Partnerships

## GWP SA IN ACTION

### + News

Tanzania discusses post 2015 national priorities for water

16th WaterNet/WARFSA/GWPSA Symposium

ILC, GWP & IWMI hold land and water governance workshop

Infrastructure and Gender mainstreaming high on agenda during Malawi Water Week consultations

Economically Water Insecure Regions\_Synthesis Report

Youth mobilization and awareness session held to advance water related issues in Madagascar and Regionally


Malagasy stakeholders contribute to Fourth Phase

## NEPAD Networks of Centre of Excellence in Water Sciences Launch Phase II Programme and expand network to Eastern and Central Africa




Share:   

Posted: 2016-05-27



Research and Development (R&D) Institutions have a key role to play in Africa's economic renewal and sustainable development, by improving conservation and utilisation of the continent's water resources through R&D efforts. In its stride to continue collaborating with R&D institutions, GWPSA's Executive Secretary, Ms Ruth Beukman participated at a kick off of the NEPAD Networks of Centre of Excellence (CoE) in Water Sciences Phase II meeting held at the Southern Sun- The Cullinan hotel in Cape Town, South Africa from the 24<sup>th</sup> to the 26<sup>th</sup> of May, 2016.



The Phase II for the NEPAD CoE in Water Sciences and Technology in Africa (ACE WATER-2) is a project supported by The Commission's Directorate-General for International Cooperation and Development (DG DEVCO), a body responsible for designing European international cooperation and development policy and delivering aid throughout the world. In this context, DG DEVCO is supporting the establishment of a Human Capacity Development Programme of the African Ministers' Council on Water (AMCOW) for the water sector in Africa and to expand the NEPAD initiative to the Eastern and Central African region. The project also aims at improving the regional capacity development, scientific and technical data analysis, management and sharing (On-line Atlas on Regional Water Cooperation, water resources security and Sustainable Development Goals (SDGs), Water-Energy-Food Security Nexus assessment).

# GWP SA Report – 27 May 2016

NEPAD launched the Southern Africa and Western Africa CoE Programmes in 2009 to specifically identify and reinforce R&D capacities in Africa through building regional networks of Centres of Excellence in water sciences.

**This program is in line with Africa's Science and Technology Consolidated Plan of Action (CPA).**

In Southern Africa, the Centres are coordinated by the University of Stellenbosch (South Africa), and include members such as the International Center for Water Economics and Governance in Africa (Mozambique), KwaZulu-Natal University (South Africa), Western Cape University (South Africa), University of Malawi (Malawi), University of Zambia (Zambia), University of Botswana (Botswana), The Council for Scientific and Industrial Research CSIR (South Africa), and the Polytechnic of Namibia (Namibia)

# Scientific Workshop held in Accra, Ghana: 31 October – 4 November 2016





# Scientific Workshop held in Accra, Ghana: 31 October – 4 November 2016



European  
Commission



## OBJECTIVE

Introduce main scientific pillars of interest:

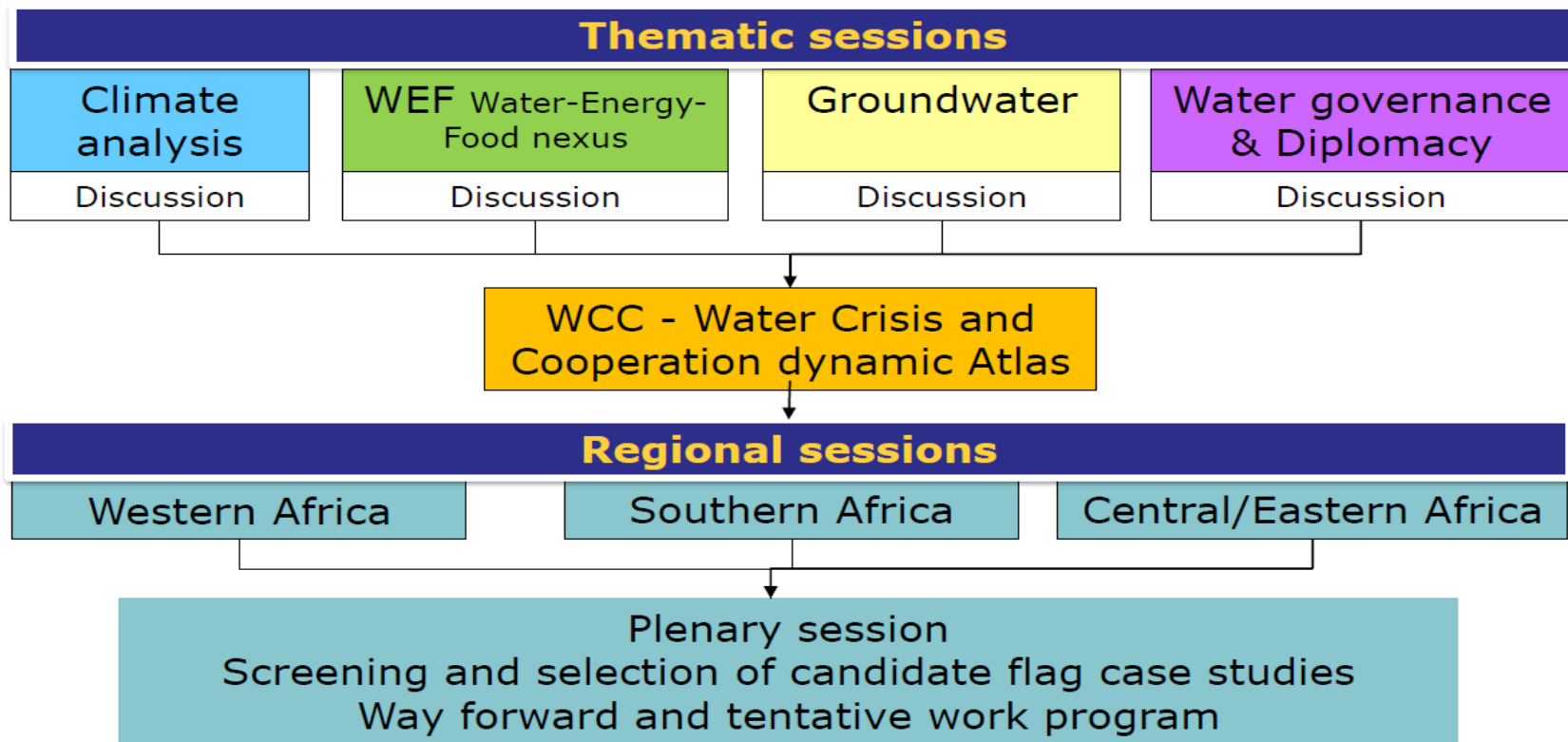
- CC/V (Climate Change/Variability)
- WEF (Water-Energy-Food) nexus
- **Groundwater**
- Water Governance and Diplomacy
- WCC (Water Crisis and Cooperation) dynamic atlas

Themes are briefly discussed with reference to sample case studies, methods and tools in the framework of past and ongoing research at JRC. Specific session and discussion on Water Governance and Diplomacy on Wednesday, November 2<sup>nd</sup>.

# Scientific Workshop held in Accra, Ghana: 31 October – 4 November 2016



## WORKSHOP ROADMAP



# Scientific Workshop held in Accra, Ghana: 31 October – 4 November 2016



European  
Commission



## WATER CRISIS AND COOPERATION

Theoretical framework based on the following question:

- Is **water scarcity** (low supply and/or high demand) likely to increase international **conflicts** in transboundary basins? (Malthusian)

OR

- Are **shared waters** likely to be catalyst for international dialogue and **cooperation** for more efficient allocation of the resource? (Cornucopian)

OR MAYBE

- Are **both** conflicts (usually non-violent) and cooperation likely to occur in the context of **water allocation**?
- We look at:
  - Impacts of **water stress** on the relations between countries in the river basin;
  - Determinants of **water demand** for human consumption, food, energy, and ecosystems;
  - Implications of geographical, socio-political and economic factors.

Joint  
Research  
Centre

# Scientific Workshop held in Accra, Ghana: 31 October – 4 November 2016



## GROUNDWATER

- Challenges of aquifers systems characterization (geometry, hydrogeological properties)
- Recharge/storage/discharge assessment (even more critical in fractured bedrock)
- Impact on groundwater quality
- Guideline for monitoring assessment
- Artificial recharge (see also to positive impact of flooding on recharge before dry season)
- Specific issues, as knowledge of drilling technique, monitoring strategies

# Scientific Workshop held in Accra, Ghana: 31 October – 4 November 2016

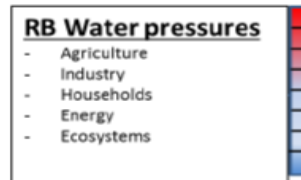


## WCC ATLAS – A CONCEPTUAL FRAMEWORK

Biophysical variables  
**SUPPLY SIDE**



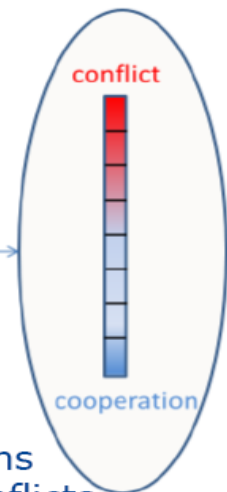
Water use estimates  
**DEMAND SIDE**



Endogenous factors  
(legal, socioeconomic,  
and cultural context)



Conditions  
favoring conflicts  
or cooperation

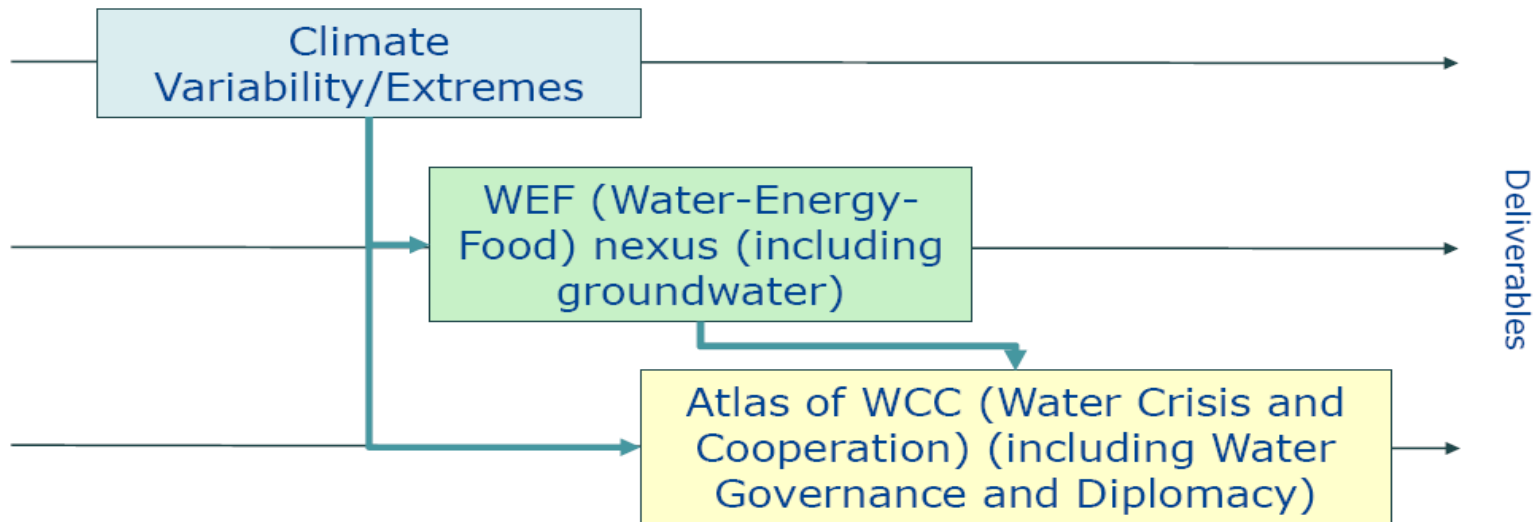


Note: We use 'restraint' in the political sciences and economic context, identifying the factors that impact on capability to mitigate escalating conflicts or enhancing cooperation (Bohmelt et al, 2014)

# Scientific Workshop held in Accra, Ghana: 31 October – 4 November 2016



## CLIMATE, WEF AND WCC ATLAS INTERPLAY



# Scientific Workshop held in Accra, Ghana: 31 October – 4 November 2016



## WORKSHOP OUTCOMES

1. Deep share of scientific competences, interest and perspectives of CoEs network
2. Institutional networking towards the establishment of an effective sharing platform
3. Building the Atlas WCC (or other?) at regional basis exercise:
  - Southern Africa: Zambezi
  - Western Africa: Senegal and Niger
  - Central/Eastern Africa (candidate): Congo and Nile
4. The way of participating:
  - Being active in the process/analysis
  - Providing knowledge/Information/Data
  - Interest in using the results for further analysis
  - Interest in participating into the interpretation of the results
  - Interest in Capacity Building
5. Sharing on H2020 around topics and applicability issues

# Scientific Workshop held in Accra, Ghana: 31 October – 4 November 2016



## THE WAY FORWARD

1. Characterization of case studies:
  - regional/local scale data, including ground based;
  - available tools, models and documentation;
  - key issues, priorities, potential sources of conflict and/or cooperation
2. Based on selected flag case studies, agreement on participants role/contributions, depending upon specific 'local' knowledge, scientific interests and applicability of (general) lessons-learned to other basins of interest.
3. Preparation and circulation through partners of draft short state-of-the-art reports, to be used as key reference documents to build upon.



# Scientific Workshop held in Accra, Ghana: 31 October – 4 November 2016



# Scientific Workshop held in Accra, Ghana: 31 October – 4 November 2016

## Tentative Work Programme

Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17
Extended case studies documentation											
	Agreement on selection of flag case studies										
	Available data and by-products sharing										
	Conceptual framework analysis and development										
				Climate Variability/Extremes analysis							
				African WEF (Water-Energy-Food) nexus (including groundwater)							
				Atlas WCC - Methodological analysis design and development (including Water Governance&Diplomacy)							
				Operational design		First tests on geovisualization capabilities		System check and appraisal			Beta version release



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**In Closing ...**

# SA (CSIR, WRC) – China (IRCK) Engagements

There is currently a joint (CSIR, UWC and China-based IRCK; co-funded by the WRC) RW RDM review assignment:

***'A review of the implementation of groundwater protection measures, in particular Resource Directed Measures, in South Africa in the context of ChinAfrica Water Forum dialogues'***

Given the sustainable natural resources management challenges in both countries, this collaborative study with the People's Republic of China is seen as strategic in overcoming present bottlenecks and thus unlock new areas of cooperation between China and Africa in the water field.

# African Regional and Continental Developments

Announcement of the establishment of the

**Groundwater Management Institute of Southern Africa**

at the recent 17<sup>th</sup> WaterNet/WARFSA/GWP-SA Symposium held in

Gaborone, Botswana from 25-29 October 2016.

# African Regional and Continental Developments

AMCOW Secretariat want by January 2017, operationalize the

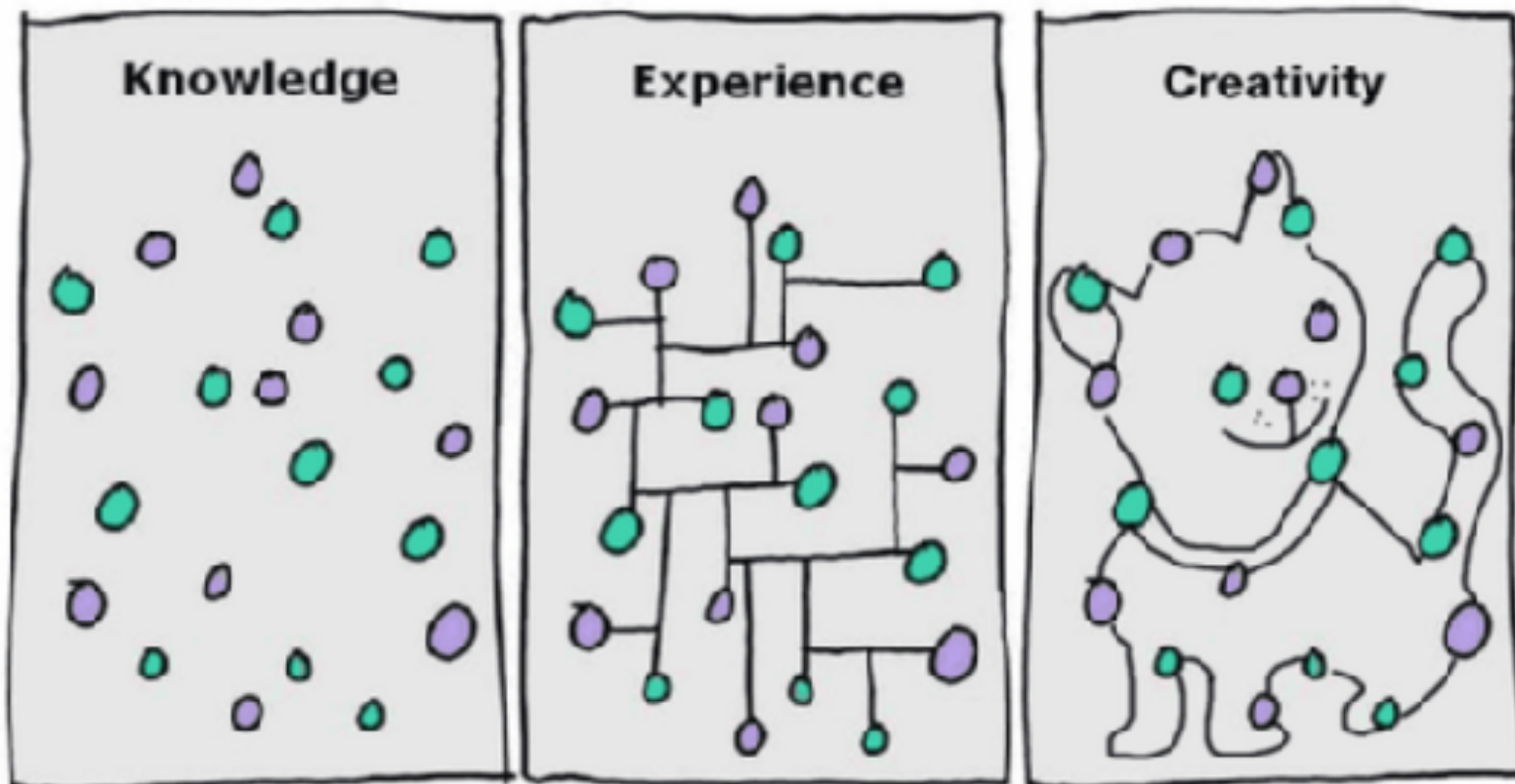
## **African Groundwater Commission (AGWC)**

**Vision:** “An Africa where groundwater resources are sustainably utilized and managed for the benefit of all”.

**Missions:**

- i. to assist Member States, Regional Economic Communities (RECs) in groundwater governance by developing, promoting their national and regional groundwater programmes in their planning and financing;
- ii. to support River, Lake Basin Organizations (RLBOs) in IWRM by ensuring that groundwater resources are included in their programmes according to AU and AMCOW decisions;
- iii. to advise AMCOW Organs ( TAC, EXCO, Secretariat) on key matters on groundwater in AMCOW policies; and,
- iv. to develop and promote education , training and capacity development by engaging educational institutions to strengthen the training and capacity development of hydrogeologists professionals and technicians , stakeholders and other groundwater users.

# With Acknowledgement to Anon!





# Thank You!