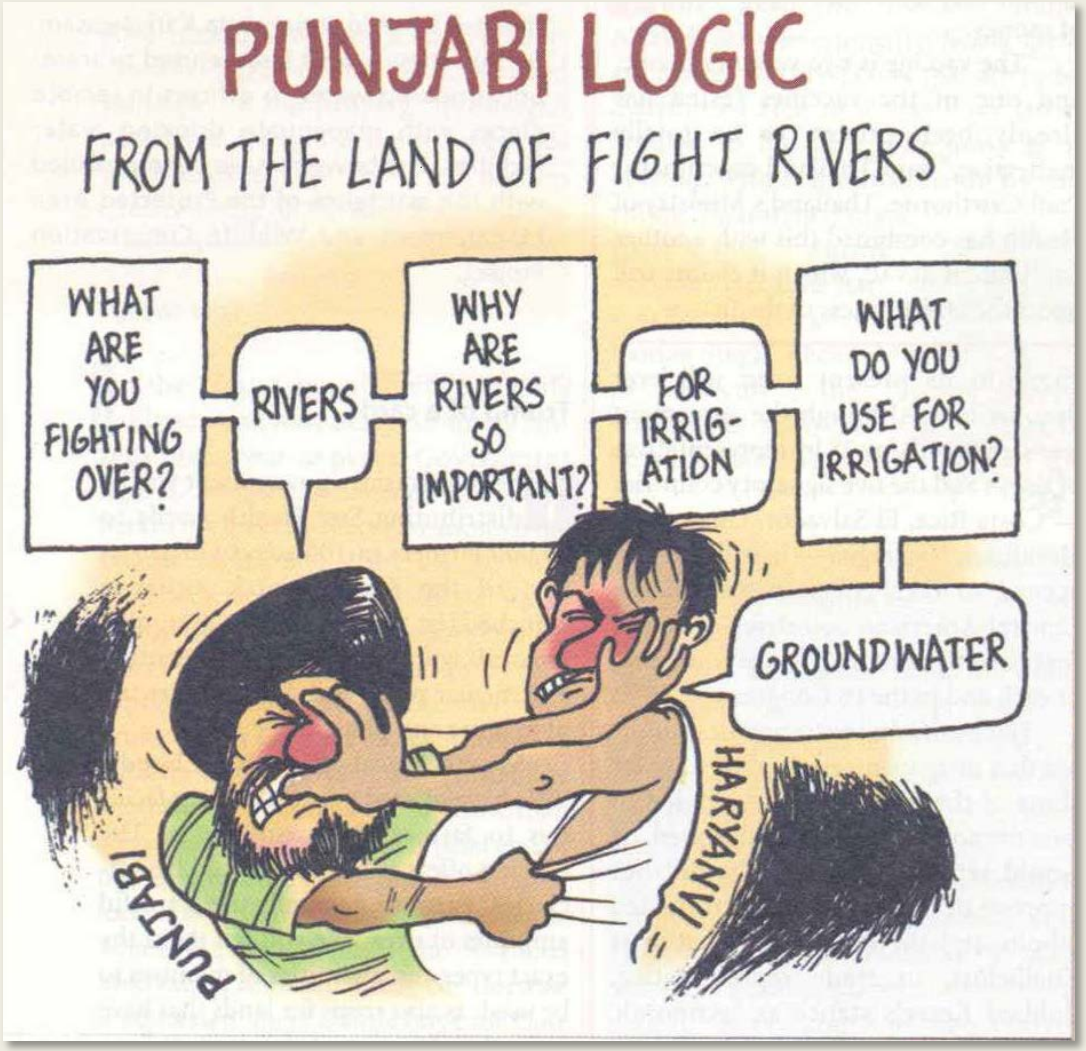
Groundwater in the Water-Energy-Food Nexus

Karen G. Villholth, IWMI International Water Management Institute

Principal Researcher

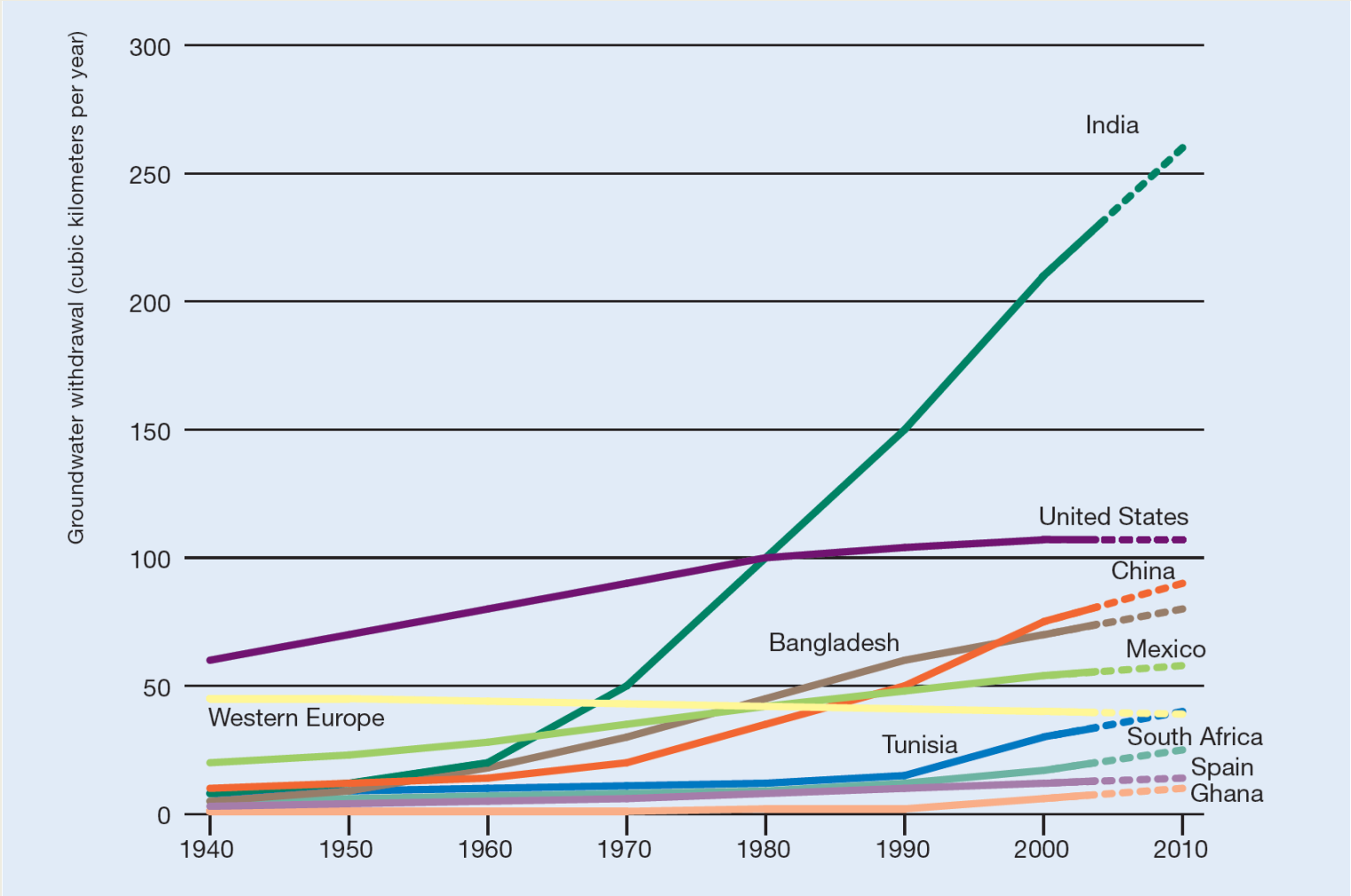
Sub-Theme Leader Groundwater and Underground Solutions

Coordinator of GRIPP



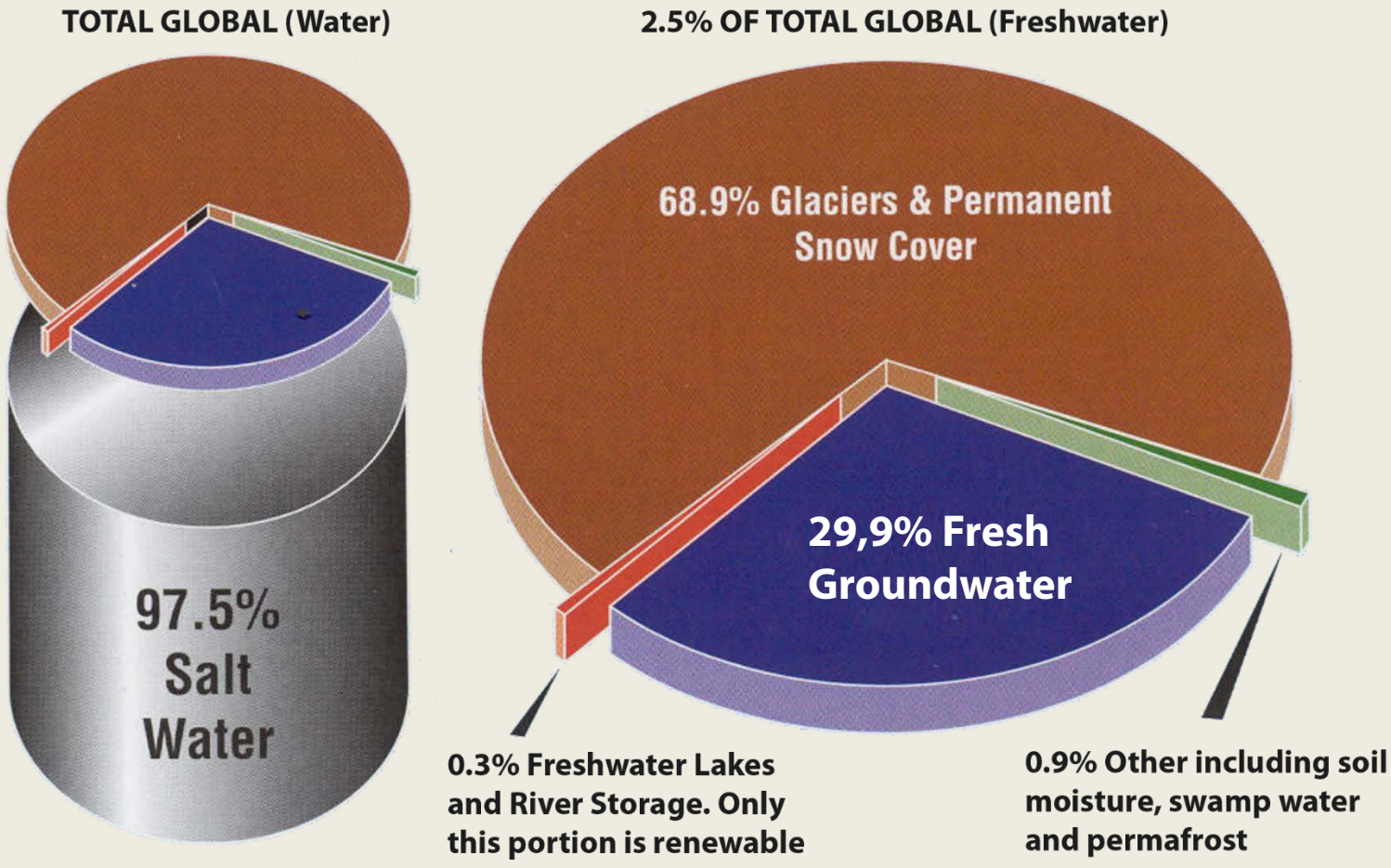
Groundwater importance is often underestimated and disregarded

Groundwater development is unprecedented

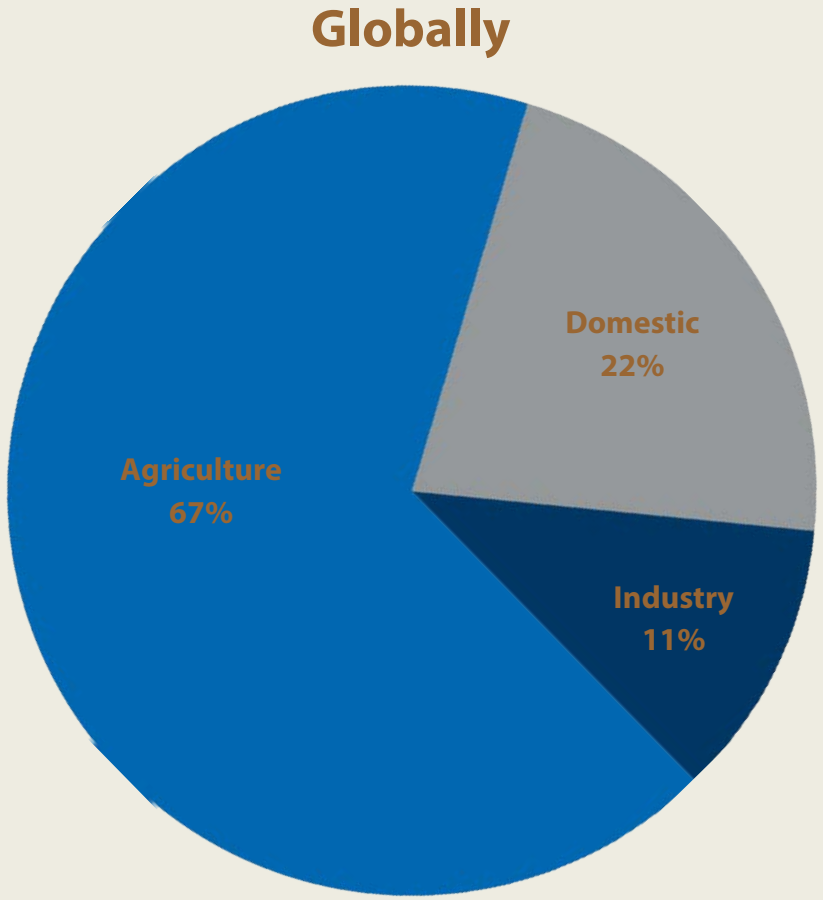


Shah et al., 2007

How much groundwater is there?

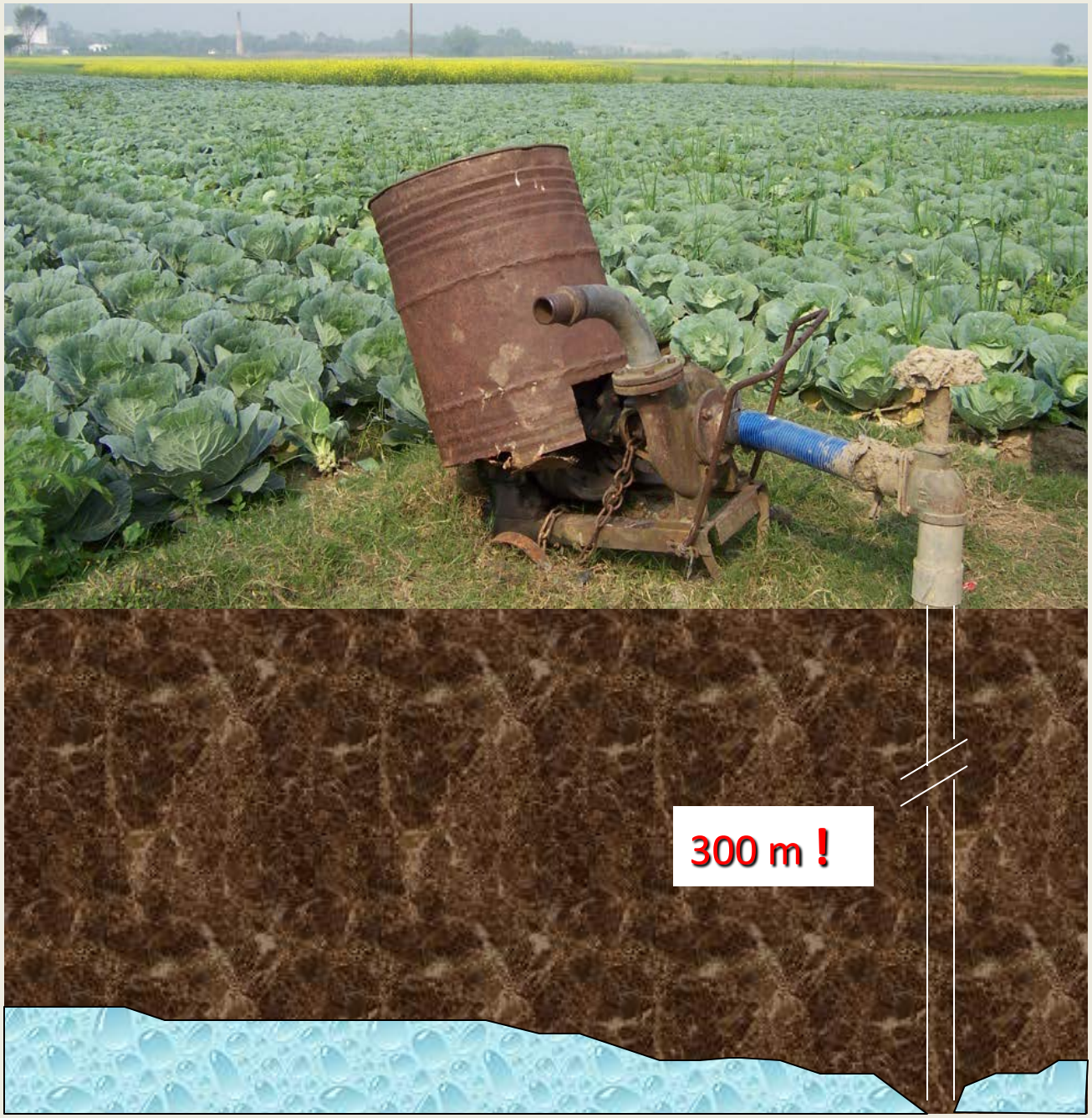


Agriculture
is the largest groundwater user



van der Gun, 2012

The hidden drought



When GW depletion is felt

LED BY IFPRI

1. How much food derives from GW and GWD?

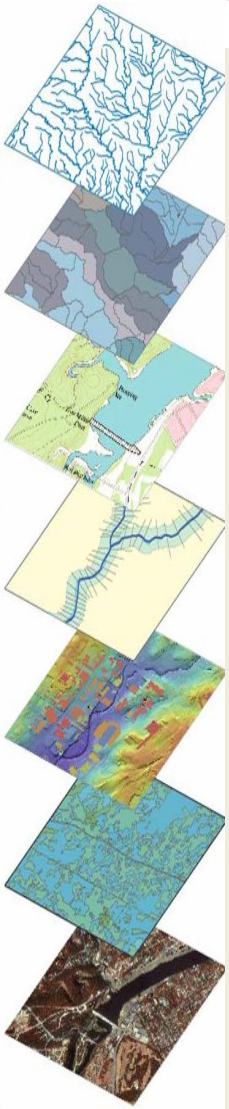
SPAM data set
Food Production
and
Harvested Area

PCR-GLOBWB data set
Groundwater
Abstraction
&
Depletion

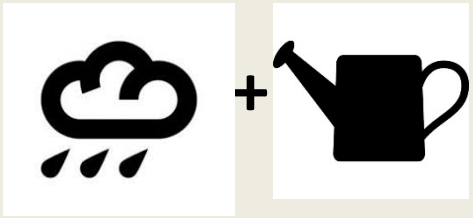
FAO data set
Percentage of Irrigated
Area by Groundwater

Grid maps of
Agricultural Water
Demand & Total Water
Demand

FINAL PRODUCT
Food Production and Harvested Area dependent on GW abstraction and GW depletion (2005)



Contribution of GW to global food production

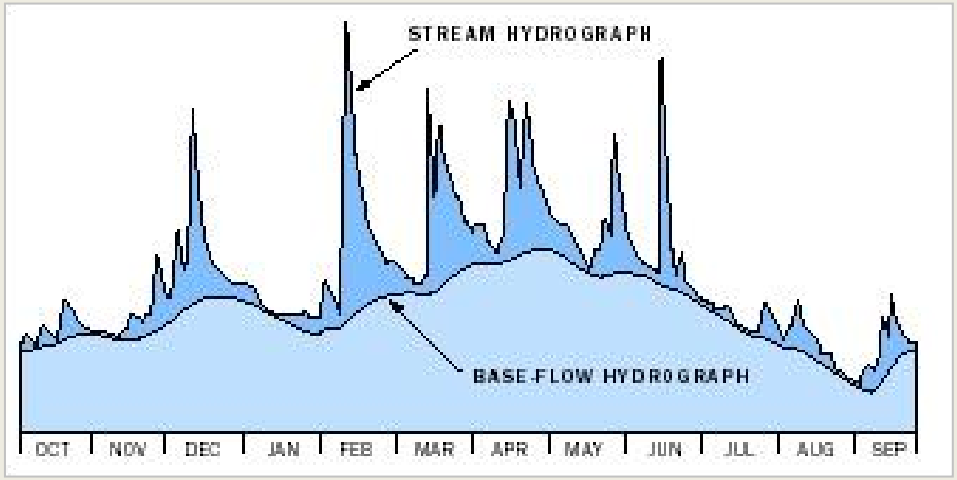


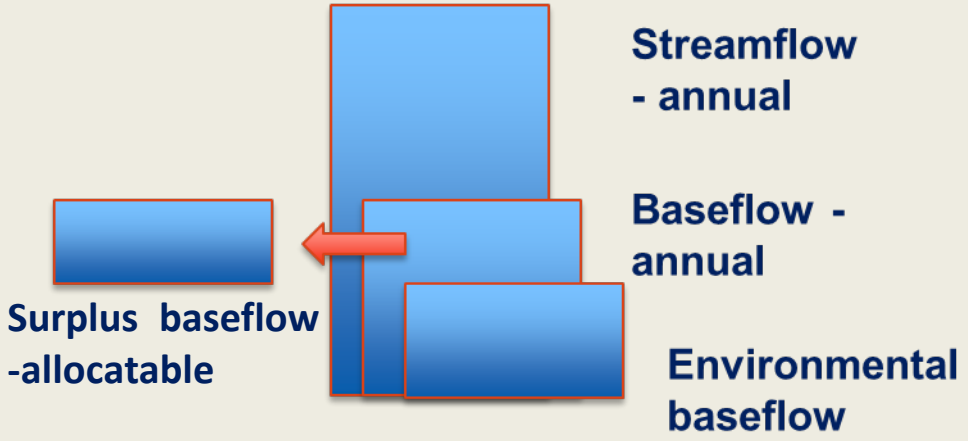
From GW abstraction	**100%**	**43.5%**	**13.0%**
From GW depletion	14.0-16.9%	6.1-7.4%	1.8-2.2%

Villholth et al., 2016

Groundwater – Environment Nexus

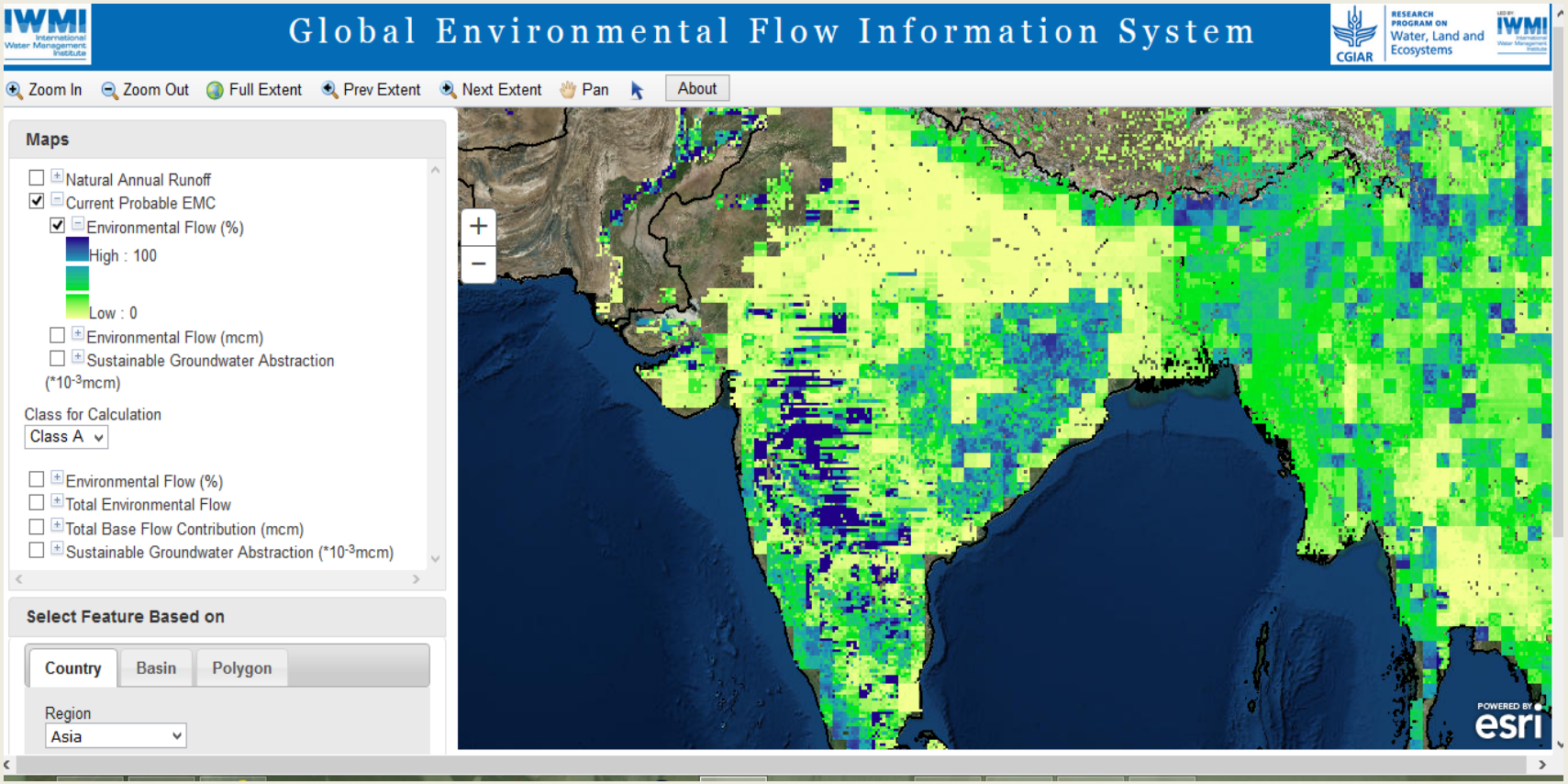
- New methodology
  - Filter baseflow from flow records
  - Estimate EF for appropriate ecological class
  - Estimate EF-related baseflow from EF
  - The difference between the “two baseflows “ is the surplus baseflow –allocatable for various uses
  - Baseflow is converted to groundwater storage is necessary to maintain it
- Applied in 21 small catchments in South Africa, results show GW development is possible in 19



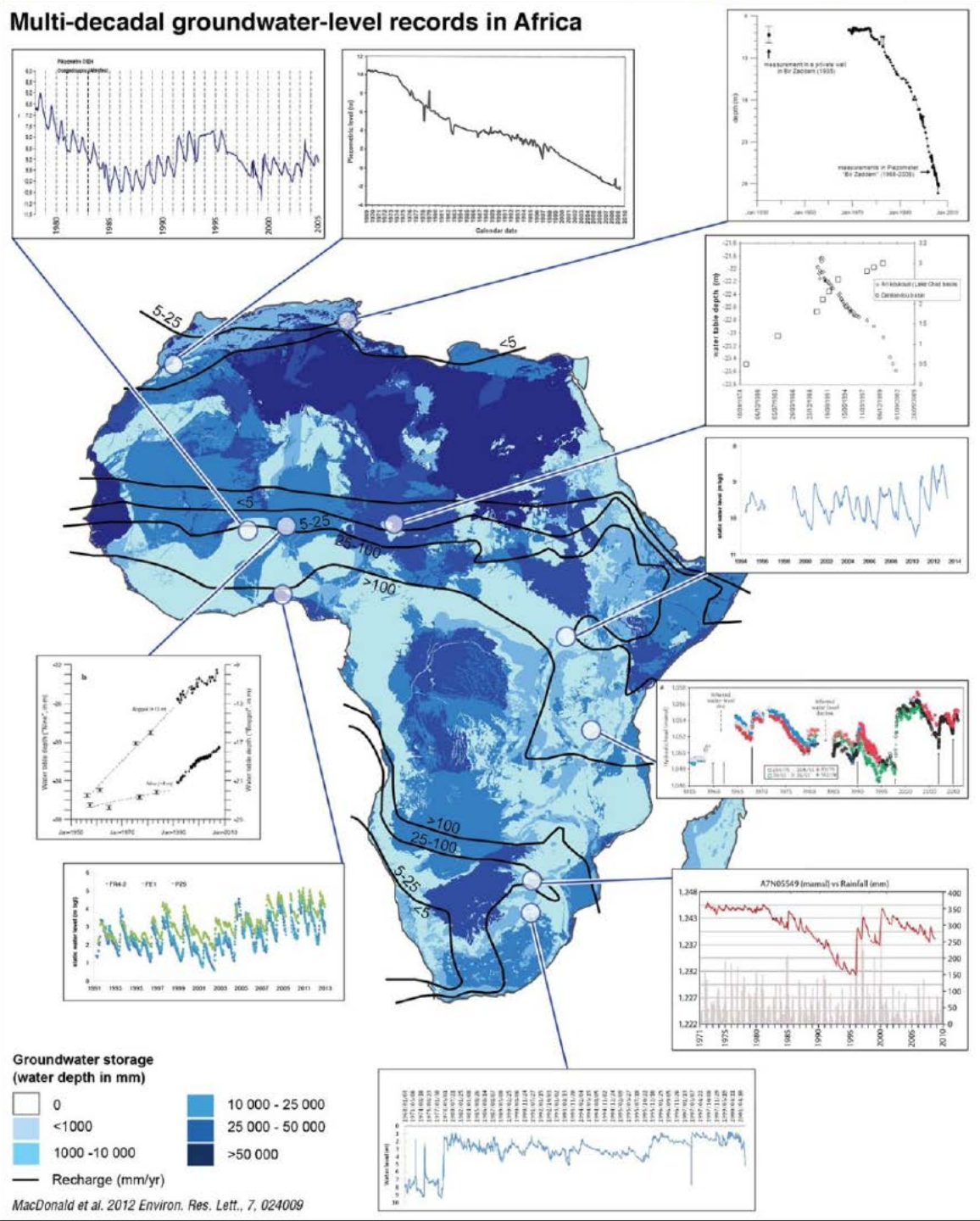


Ebrahim and Villholth, 2016

Global Environmental Flow Calculator



http://gef.iwmi.org/



Groundwater pathways influenced by:

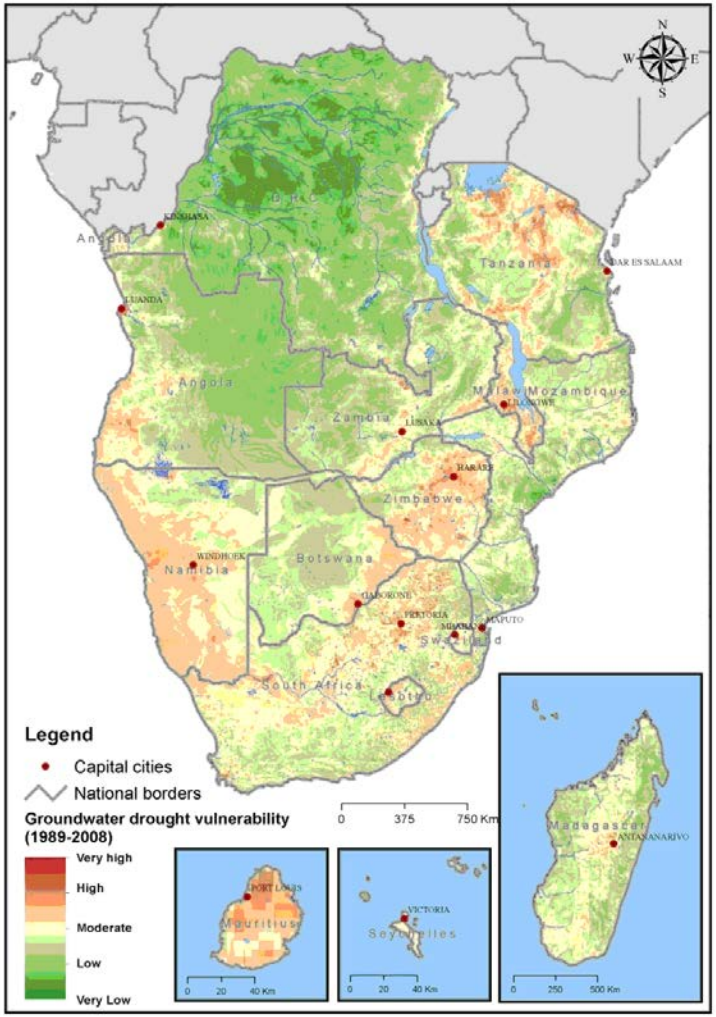
- Human development
- Climate
- Land-use
- Infrastructure

GroFutures Project:

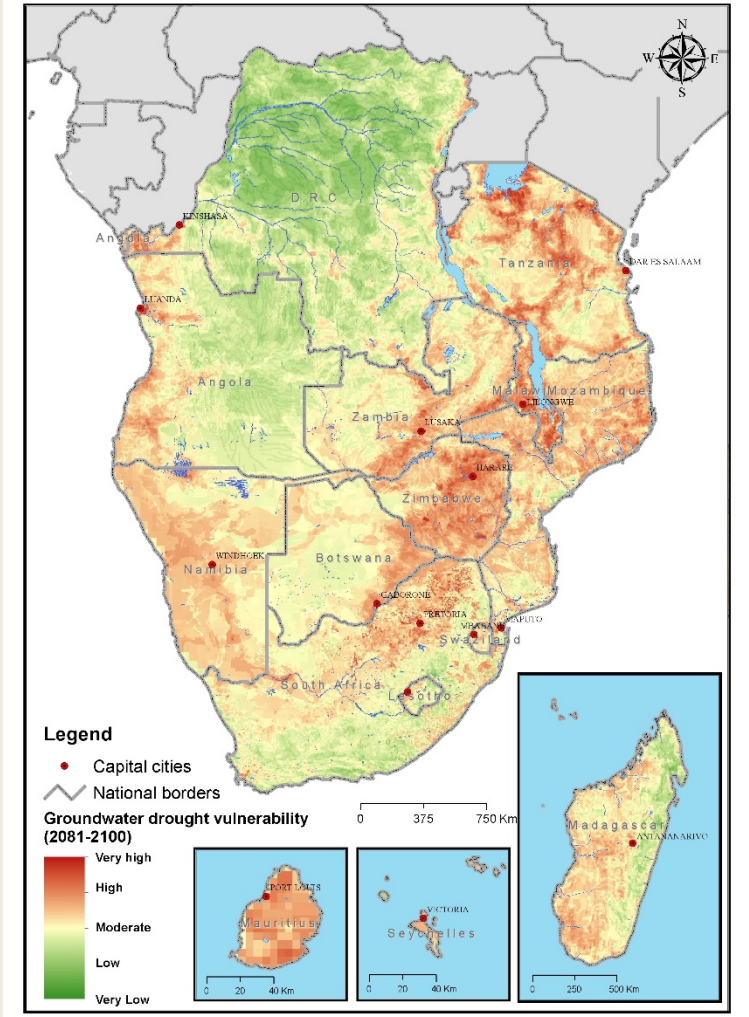
http://grofutures.org/

Groundwater Drought Risk

Present climate (1989-2008)

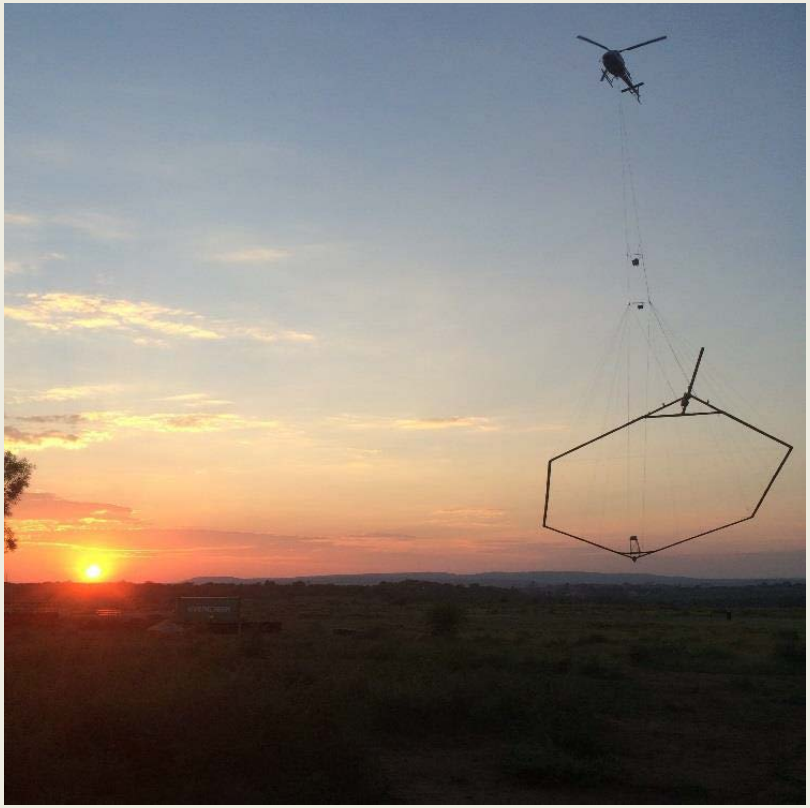


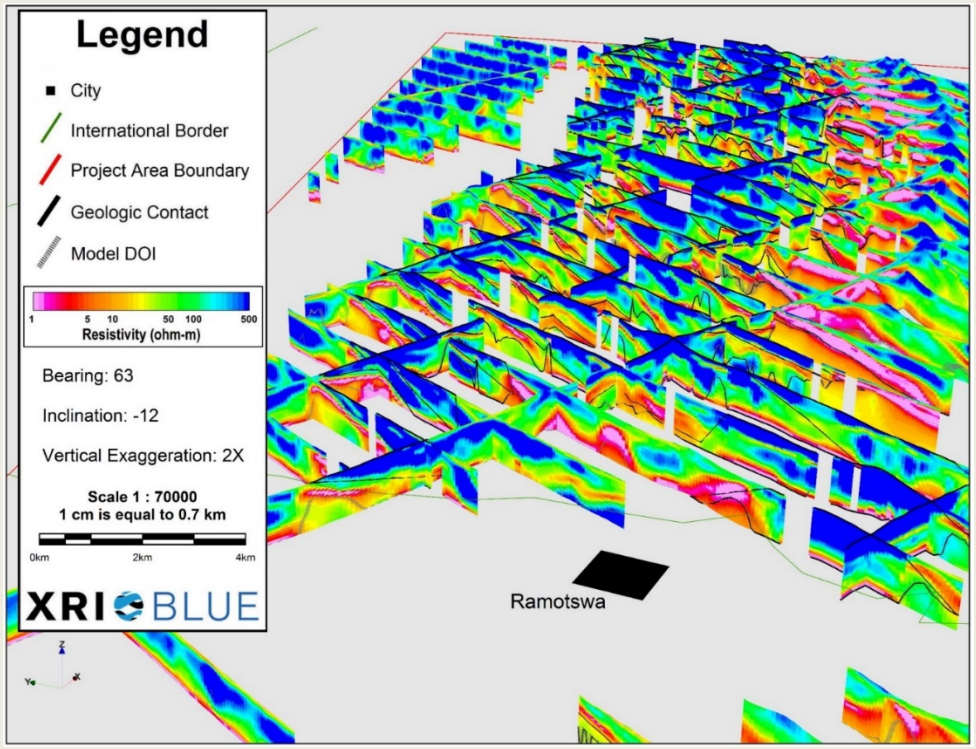
Future climate (IPCC SRES A1B, 2081-2100)



Villholth et al., 2013

Groundwater and airborne observations





RAMOTSWA Transboundary Aquifer Project:

http://ramotswa.iwmi.org/

GROUNDWATER SOLUTIONS INITIATIVE FOR POLICY AND PRACTICE (GRIPP)

A global partnership for sustainable groundwater management

IWMI Annual Research Meeting
Update to IWMI Board on GRIPP
IWMI, Battaramulla, Colombo, Sri Lanka, 18 Nov 2016

IWMI International Water Management Institute

GRIPP GROUNDWATER SOLUTIONS INITIATIVE FOR POLICY AND PRACTICE

Karen G. Villholth
Principal Researcher, Coordinator of GRIPP
IWMI
South Africa

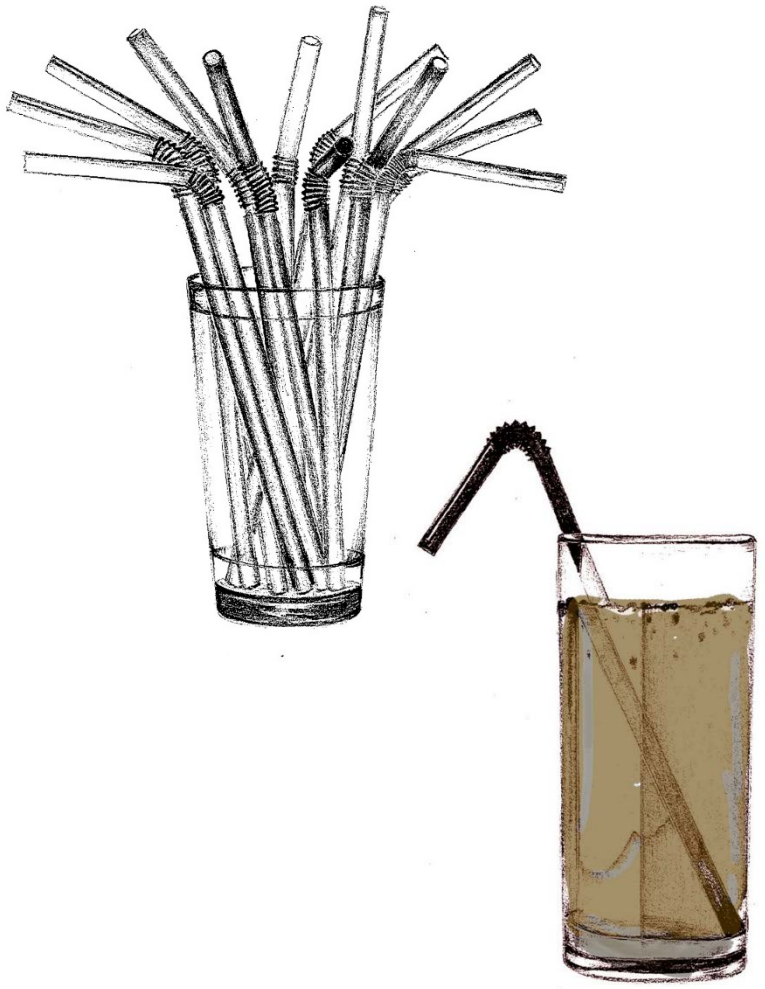
GRIPP objective

Securing groundwater resources for livelihoods, food security, climate resilience and economic growth while sustaining the resource for future generations

IWMI International Water Management Institute

GRIPP
GROUNDWATER SOLUTIONS INITIATIVE FOR POLICY AND PRACTICE
GRIPP

The toxic groundwater cocktail



Why this initiative?

- The strategic importance of groundwater is increasingly being acknowledged
- Groundwater is a lifeline for communities
- Groundwater underpins most terrestrial and aquatic ecosystems
- Groundwater supports global food security, and contributes to public health and economic growth (SDGs)

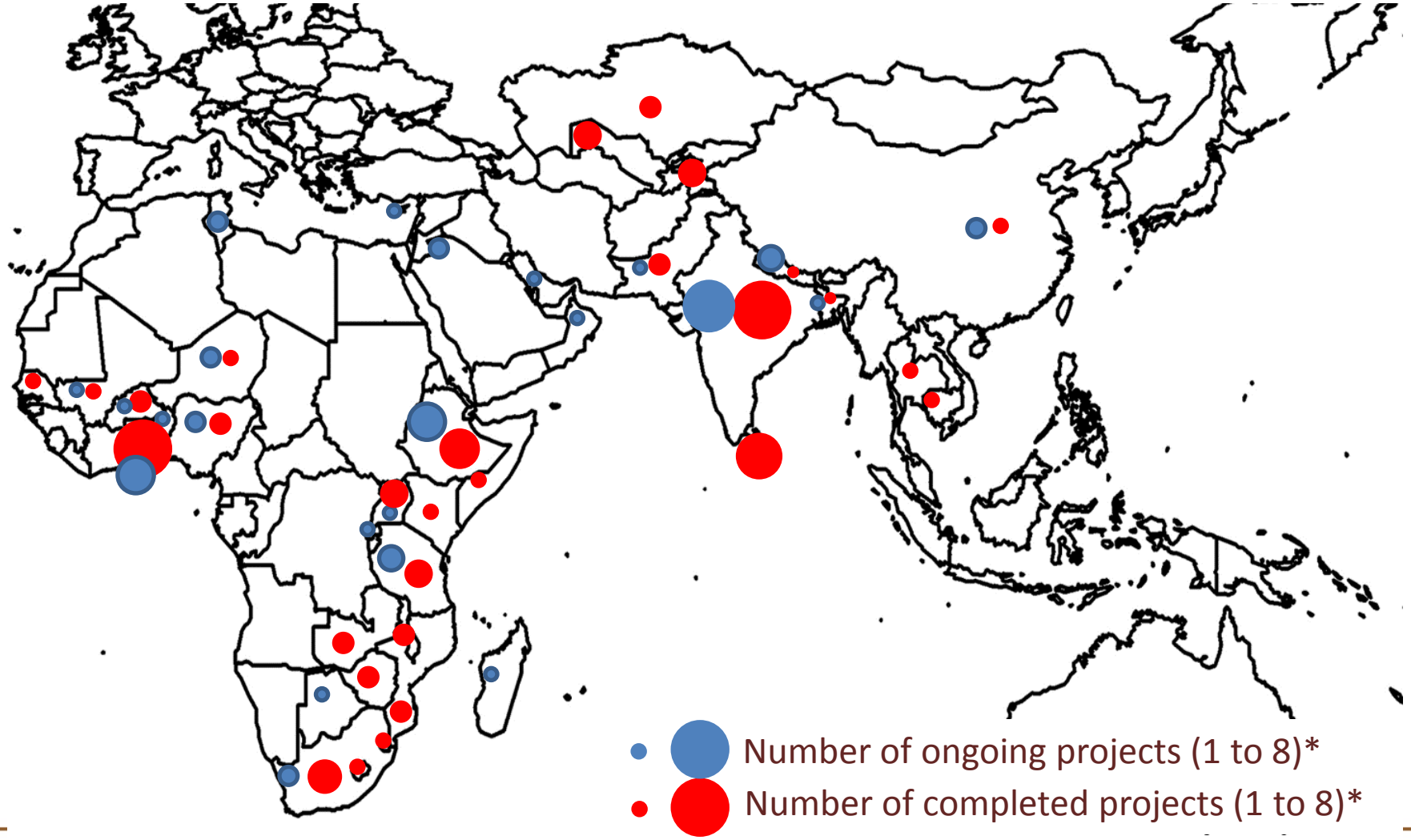
The base of GRIPP

- The Global Framework for Action Groundwater Governance Project (GEF-funded and implemented by FAO, UNESCO-IHP, IAH and World Bank)
- IWMI's three decades of research and partnerships

IWMI International Water Management Institute

GRIPP GROUNDWATER SOLUTIONS INITIATIVE FOR POLICY AND PRACTICE

IWMI project Portfolio on groundwater (2005 – 2019)



Antidote

HOW GRIPP WORKS:

- Creating long-term partnerships
- Sharing transferable solutions
- Scaling-up successes
- Filling knowledge gaps

IWMI International Water Management Institute

GRIPP GROUNDWATER SOLUTIONS INITIATIVE FOR POLICY AND PRACTICE

Added advantage of GRIPP

IWMI International Water Management Institute

GRIPP GROUNDWATER SOLUTIONS INITIATIVE FOR POLICY AND PRACTICE

Water security from groundwater

= Water security?

GRIPP presented at major events in 2016

Picture: NASA

South Asia Groundwater Forum, Jaipur, India
01 - 03 June 2016

ISMAR9, Mexico City, Mexico
20 - 24 June 2016

Sustainable Groundwater in Agriculture, San Francisco, USA
28 - 30 Jun 2016

Africa Water Week, Dar es Salaam, Tanzania
18 - 22 Jul 2016

World Water Week, Stockholm, Sweden
28 Aug - 2 Sep 2016

35th International Geological Congress, Cape Town, RSA
27 Aug - 4 Sep 2016

IAH-60, Montpellier, France
25 - 29 Sep 2016

Groundwater in Earth system Models, Paris, France
3 - 5 Oct 2016

COP22, Marrakech, Morocco
07 - 18 Nov 2016

Budapest Water Summit, Budapest, Hungary
28 - 30 Nov 2016

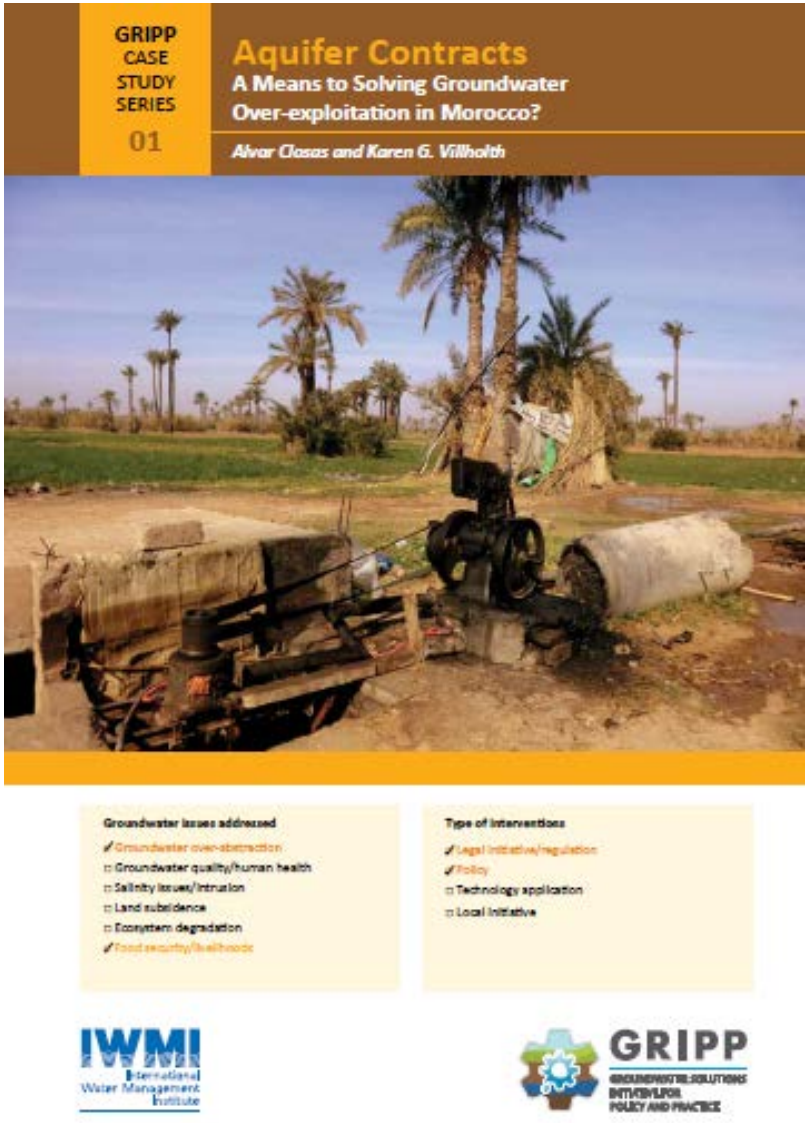
IWMI International Water Management Institute

GRIPP GROUNDWATER SOLUTIONS INITIATIVE FOR POLICY AND PRACTICE

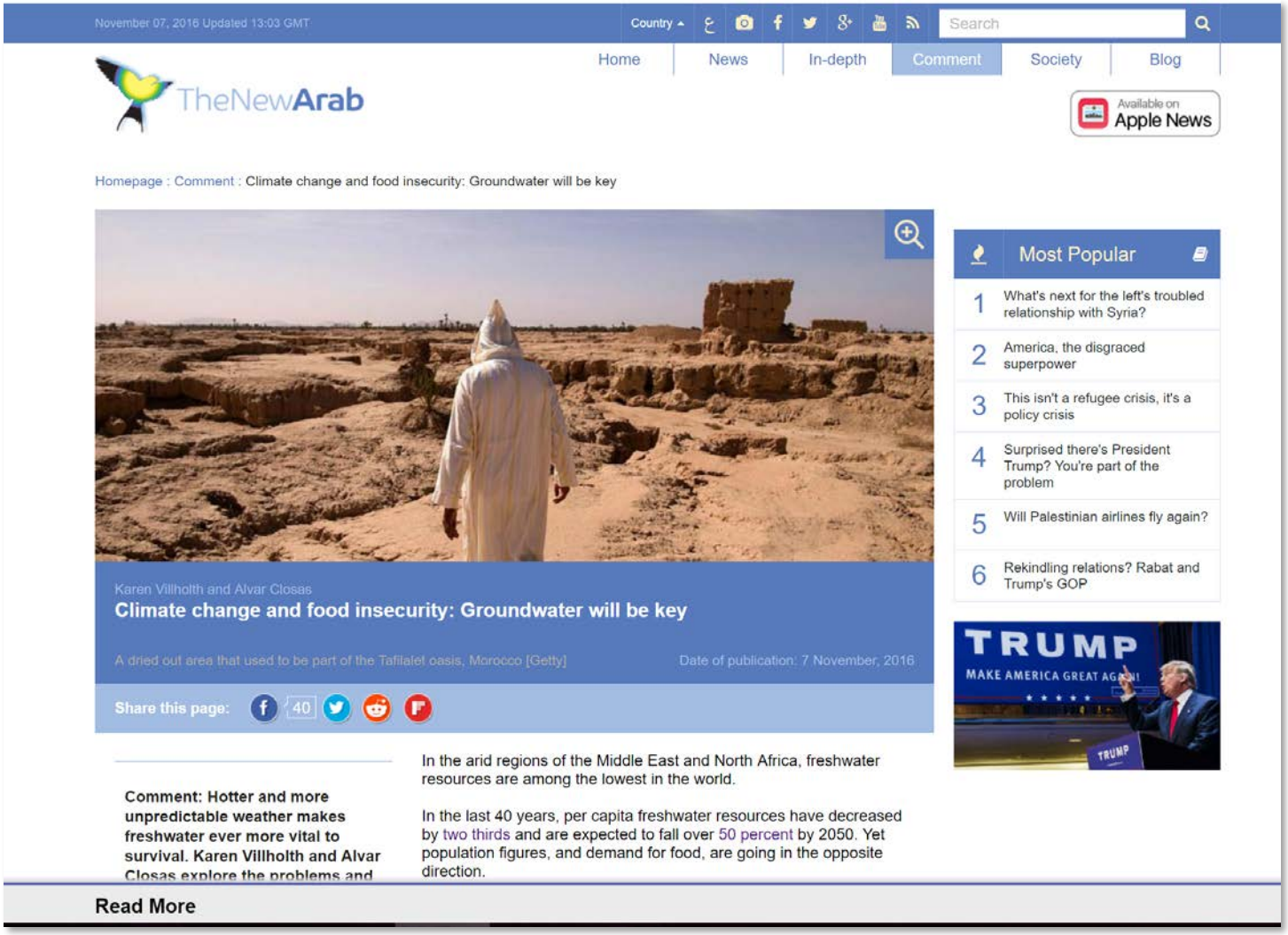
GRIPP Partners, August 2016

Case Study Briefs Series No 1

Aquifer Contracts - A Means to Solving Groundwater Over-exploitation in Morocco?
http://gripp.iwmi.org/gripp/publications/case-study-series/issue-01.pdf



News inputs



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Karen Villholth and Alvar Closas

Climate change and food insecurity: Groundwater will be key

A dried out area that used to be part of the Tafilalet oasis, Morocco [Getty]

Date of publication: 7 November, 2016

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Comment: Hotter and more unpredictable weather makes freshwater ever more vital to survival. Karen Villholth and Alvar Closas explore the problems and

In the arid regions of the Middle East and North Africa, freshwater resources are among the lowest in the world.

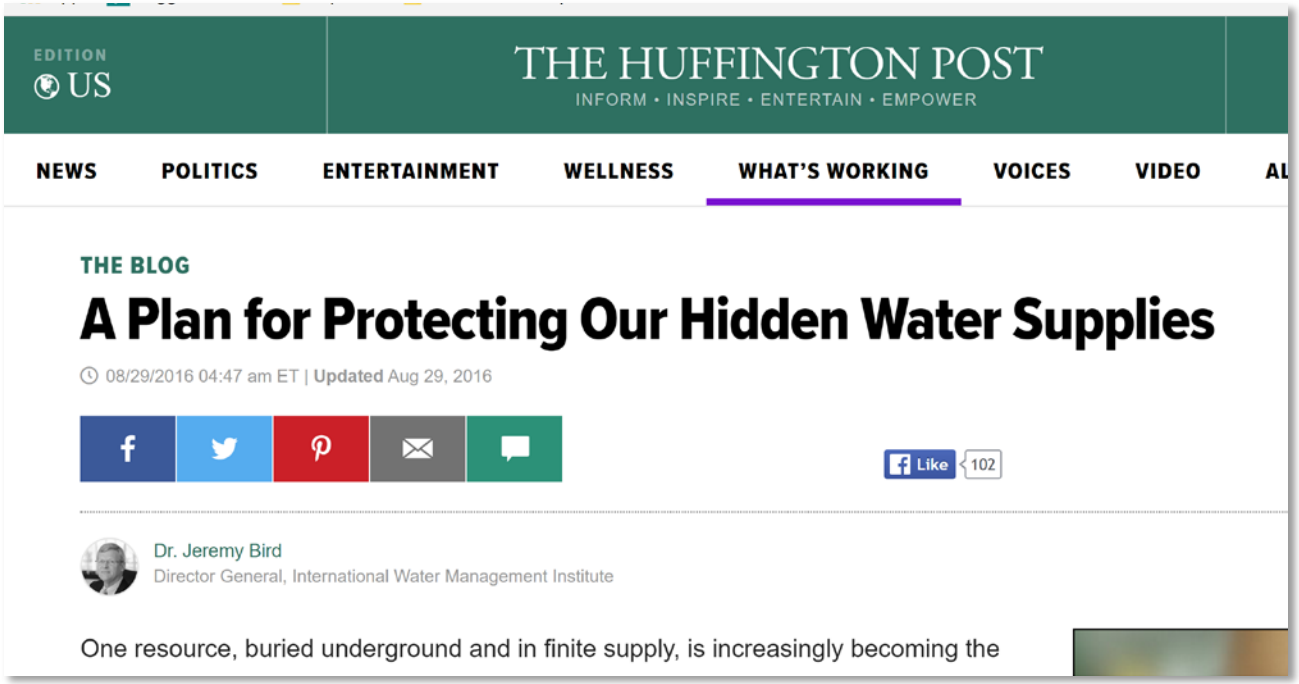
In the last 40 years, per capita freshwater resources have decreased by two thirds and are expected to fall over 50 percent by 2050. Yet population figures, and demand for food, are going in the opposite direction.

Read More

Op-ed for COP22 in Morocco

IWMI International Water Management Institute

GRIPP GROUNDWATER SOLUTIONS INITIATIVE FOR POLICY AND PRACTICE



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08/29/2016 04:47 am ET | **Updated** Aug 29, 2016

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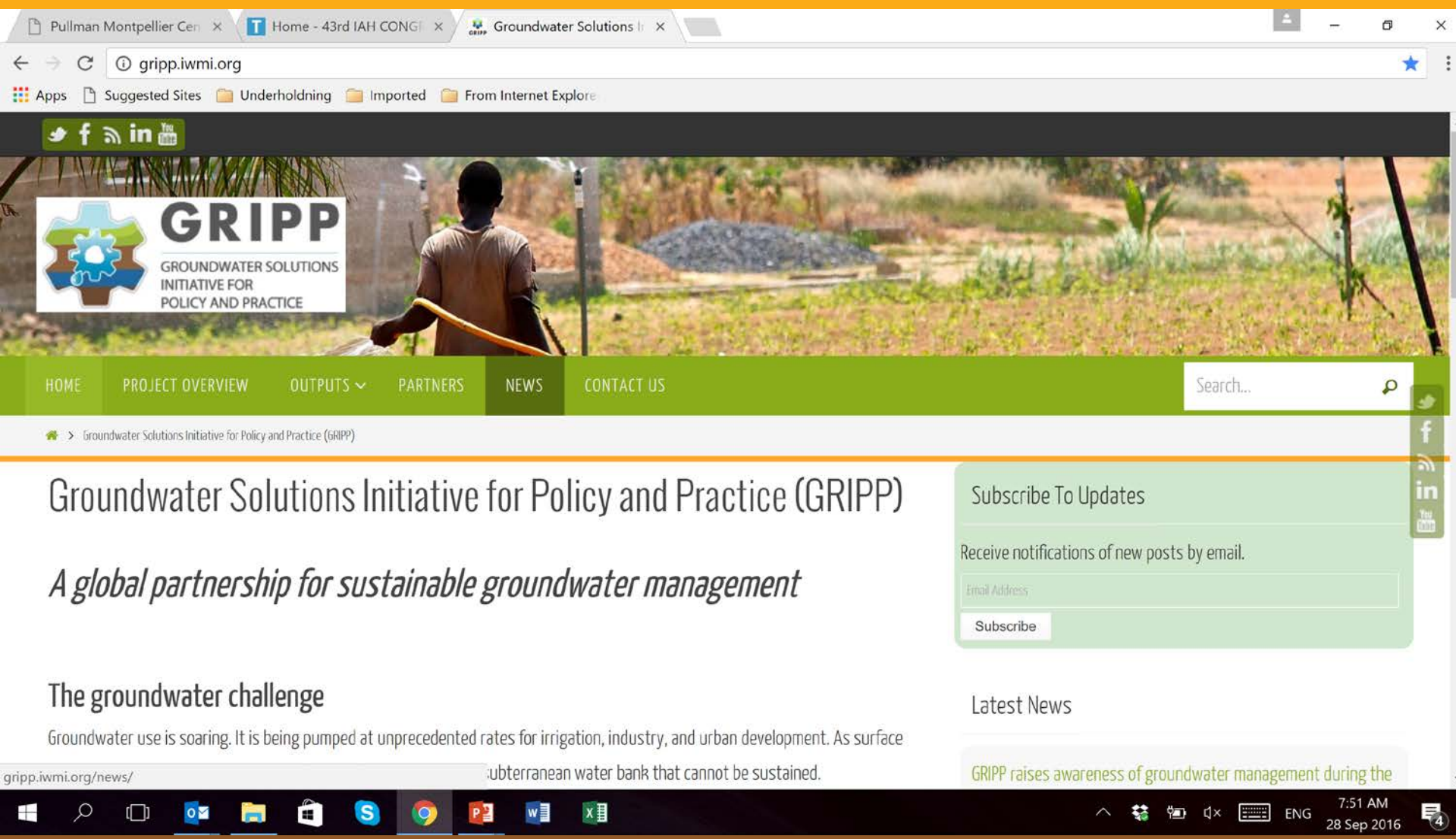
Dr. Jeremy Bird
Director General, International Water Management Institute

One resource, buried underground and in finite supply, is increasingly becoming the

Op-ed for WWW in Stockholm



Thank You

GRIPP
GROUNDWATER SOLUTIONS INITIATIVE FOR POLICY AND PRACTICE

iwmi-gripp@cgiar.org http://gripp.iwmi.org

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