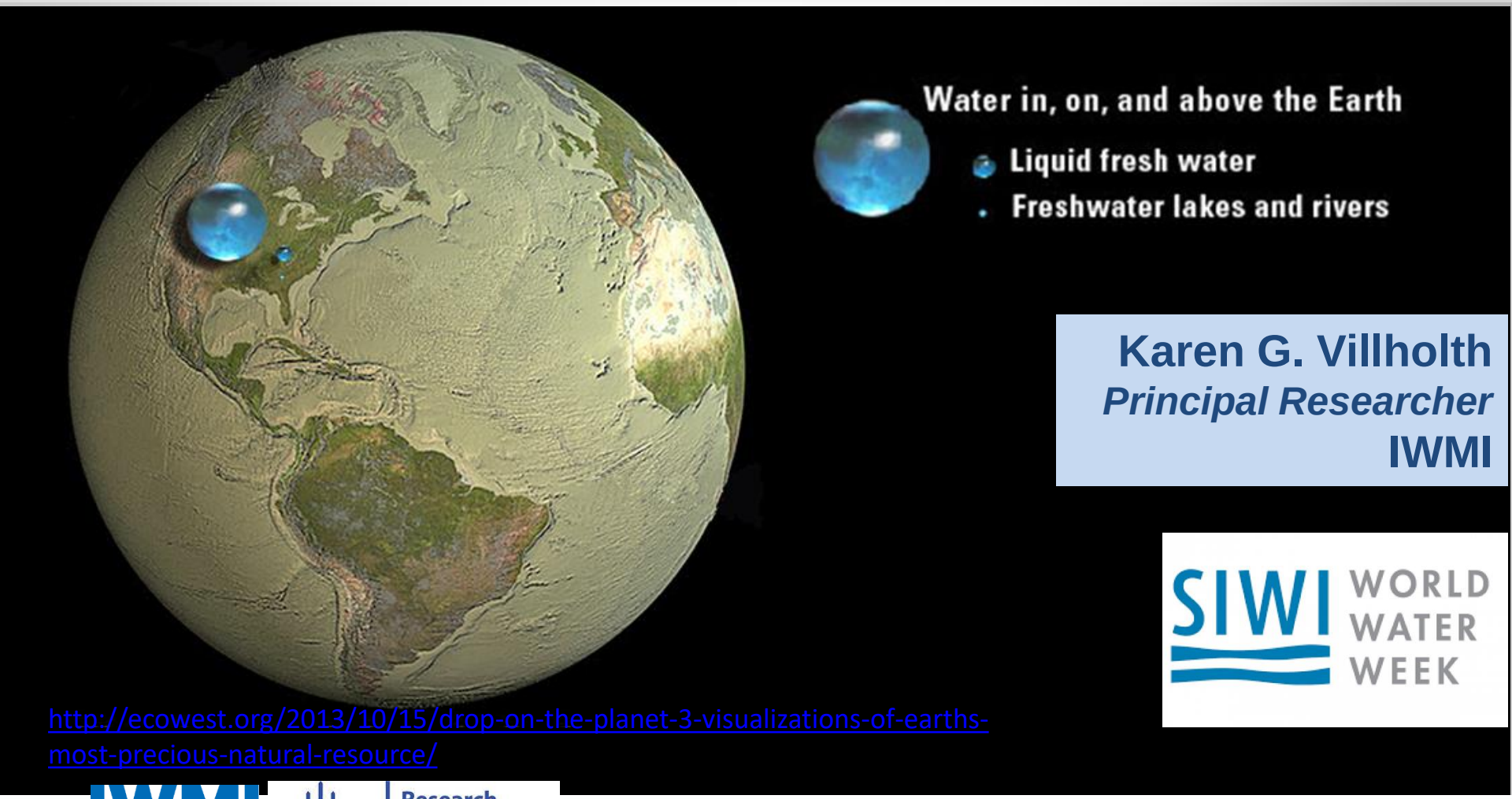
Groundwater and SDGs: discerning interlinkages for sustainable outcomes



Karen G. Villholth
Principal Researcher
IWMI

SIWI WORLD WATER WEEK

http://ecowest.org/2013/10/15/drop-on-the-planet-3-visualizations-of-earths-most-precious-natural-resource/

The **International Water Management Institute** is a non-profit, scientific research organization focusing on the sustainable use of water and land resources in developing countries

Our **vision** is
a **water-secure world**

Our **mission** is to find
water solutions for sustainable development

Food

To improve food security while sustainably managing water resources & conserving ecosystems

Climate

To adapt and mitigate climate change while building resilience to disruption

Growth

To reduce poverty and advance inclusion and equality as agriculture transforms, energy transitions and urbanization intensifies

Our history

- **1984**: Established in Sri Lanka as the International Irrigation Management Institute (IIMI)
- **1991:** Joined the CGIAR
- **1996**: Broadened mandate: became the International Water Management Institute (IWMI)
- **2012**: Awarded Stockholm Water Prize
- **2013**: Selected to lead CGIAR Research Program "Water, Lands and Ecosystems"

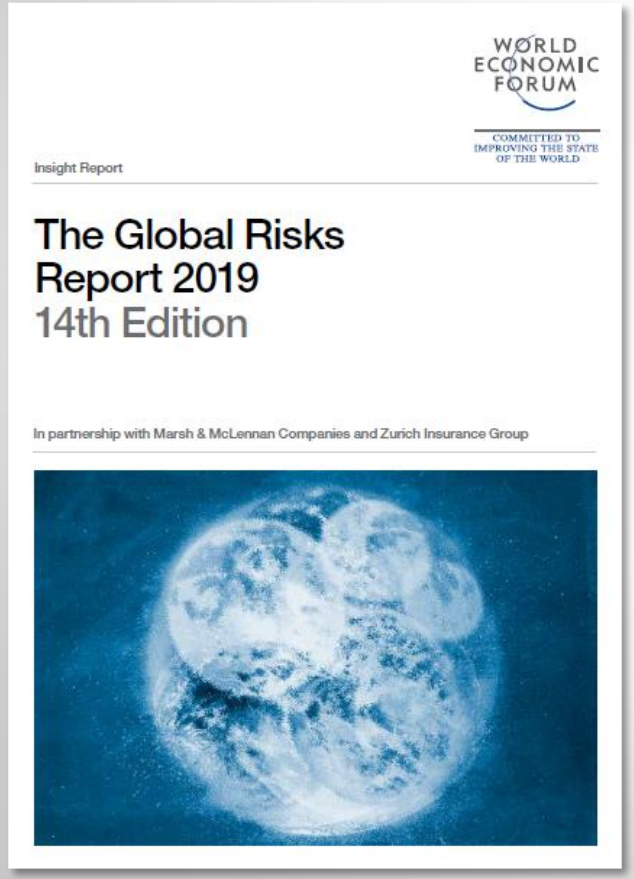
CGIAR

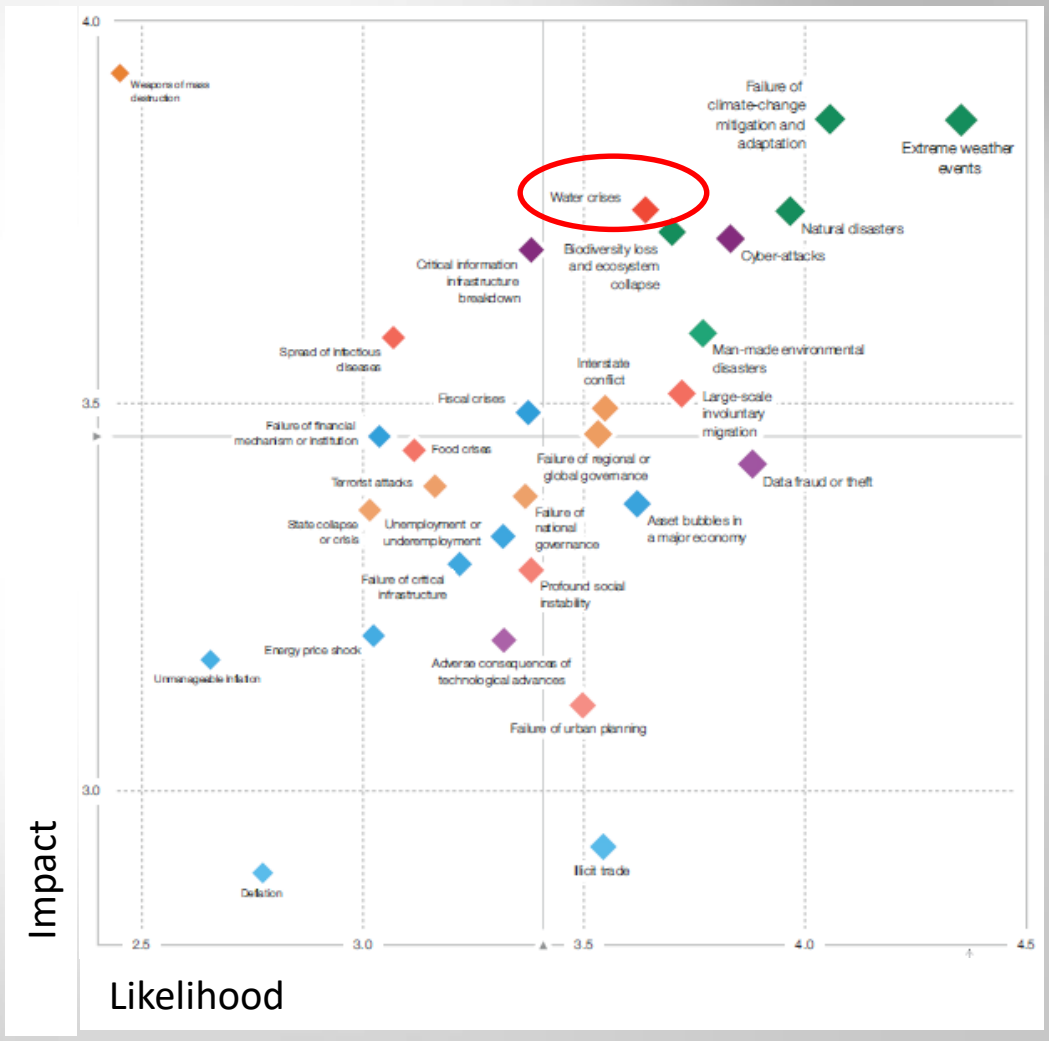
Research Program on Water, Land and Ecosystems

Our offices

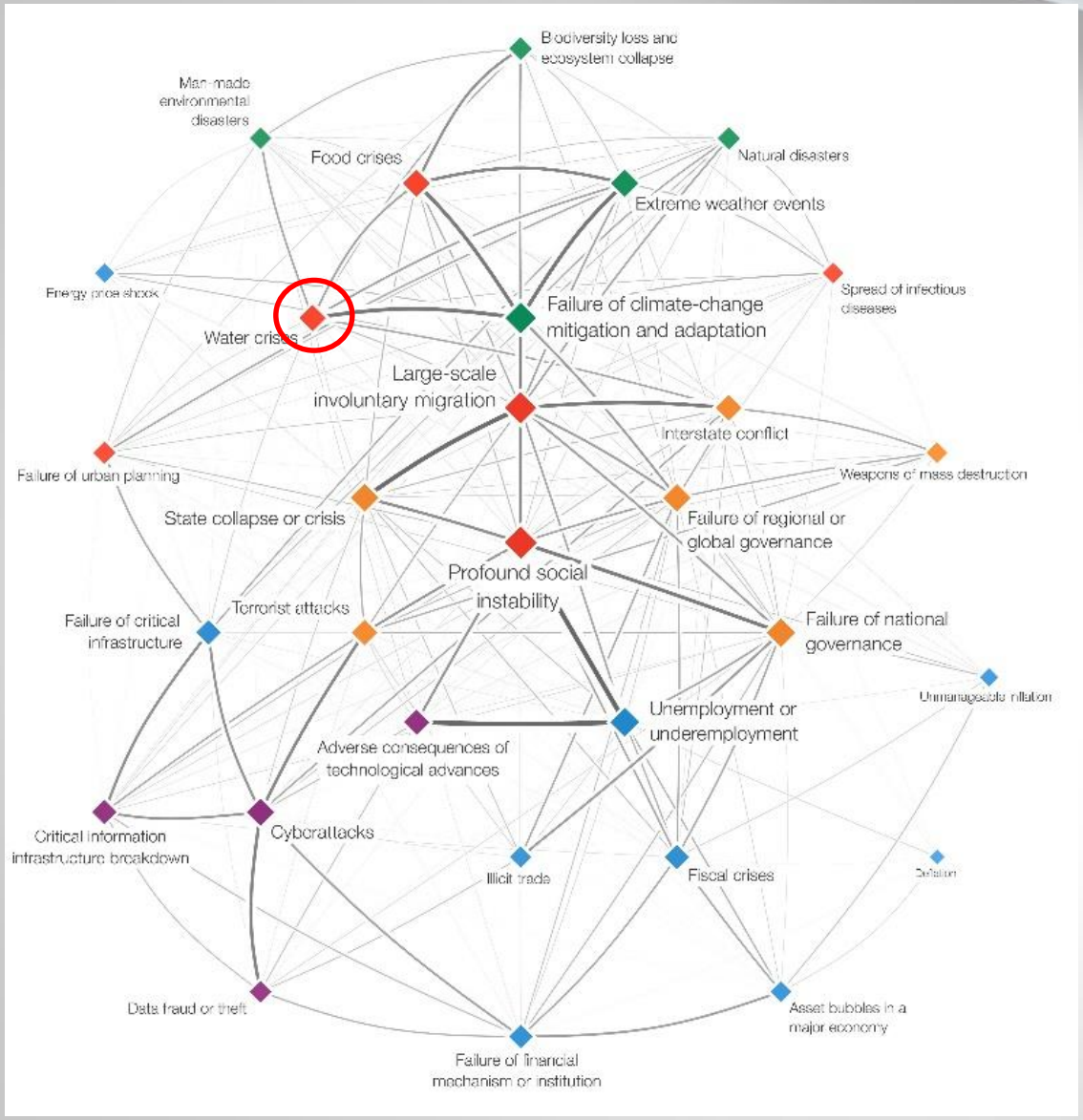

IWMI office locations and countries where we have projects underway
Leiden
Bonn
Washington, DC
Tashkent
Lahore
Kathmandu
Cairo
Anand
Delhi
Vientiane
Ouagadougou
Yangon
Addis Ababa
Accra
Colombo
Pretoria
Headquarters
Regional/Country Offices
Representative Offices
Project Offices
Projects

Water is becoming a global concern

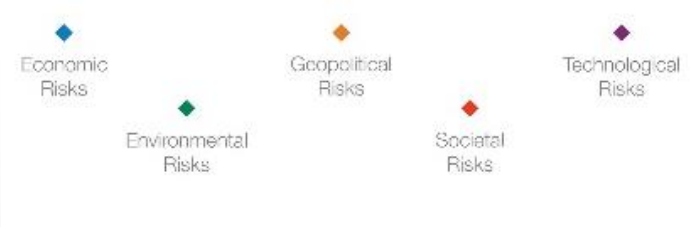




https://www.oliverwyman.com/our-expertise/insights/2018/jan/global-risks-2018.html

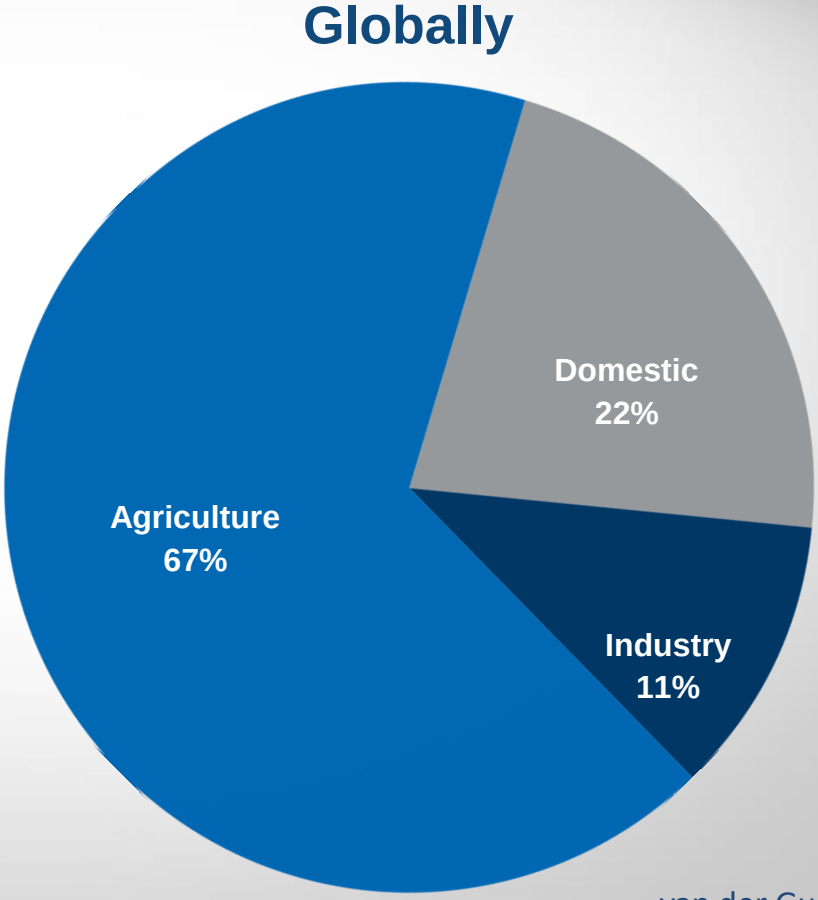


Understanding the scale of, and interconnections between the risks is key to building effective strategies to manage them



https://www.oliverwyman.com/our-expertise/insights/2018/jan/global-risks-2018.html

Agriculture is the largest groundwater user



van der Gun (2012)

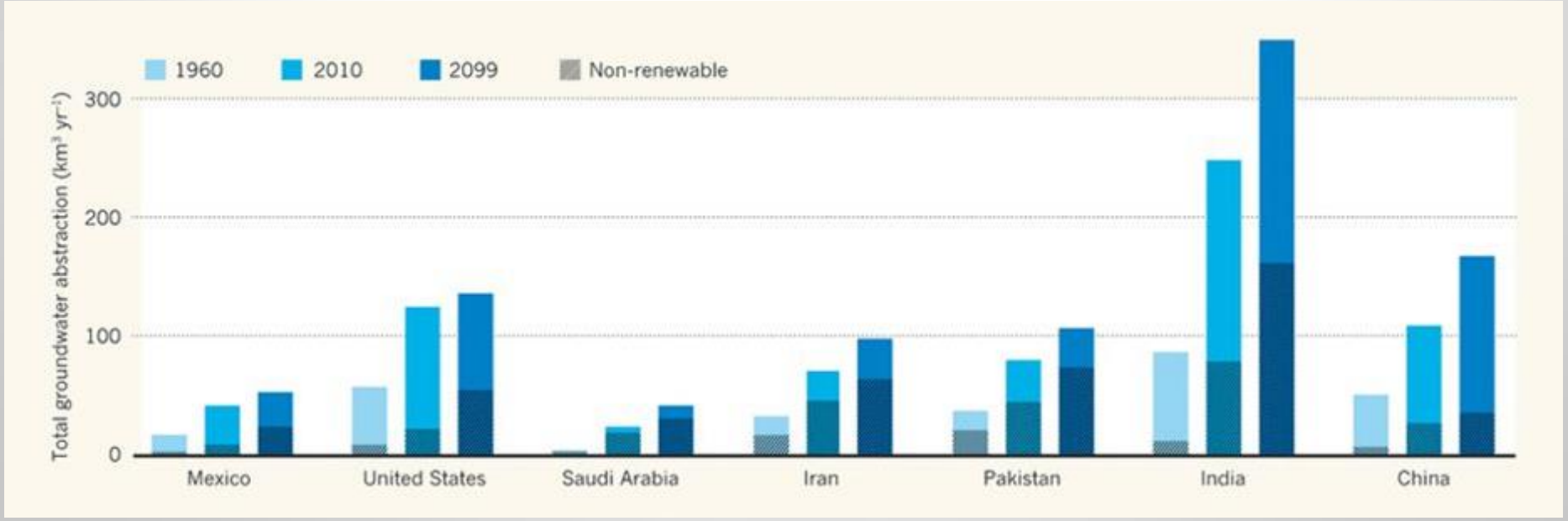
Groundwater and agriculture

- >40% of global food production rely on groundwater (Foster et al., 2015)
- One billion farmers in India, China, Bangladesh and Pakistan are dependent on groundwater for irrigation (Villholth et al., 2009)
- 20% of global irrigation from groundwater depletion (Wada et al., 2012)
- 15% of global food production from groundwater is unsustainable (Villholth et al., 2016)

Trends in groundwater development

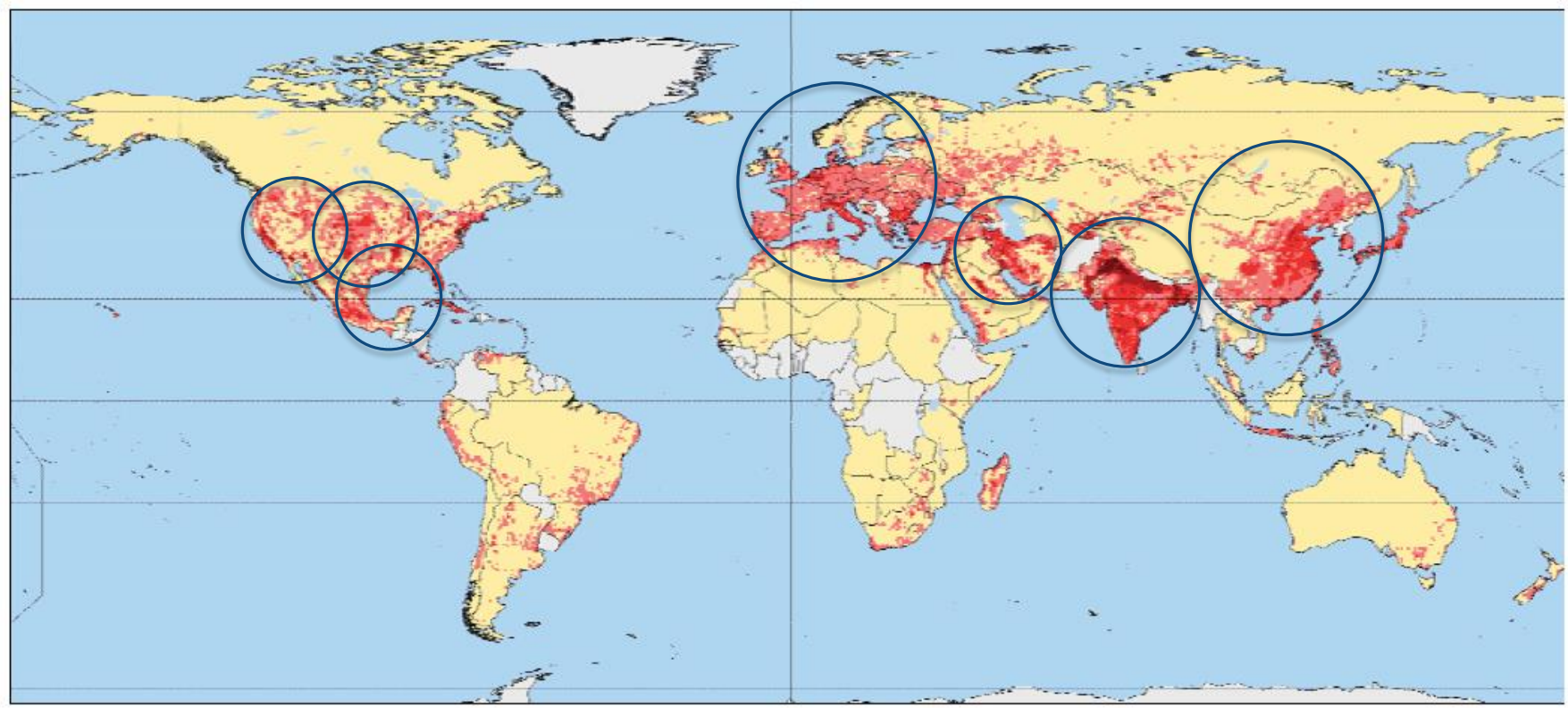
Seven countries account for 74% of global groundwater withdrawals in 2010

Groundwater withdrawals are rising worldwide



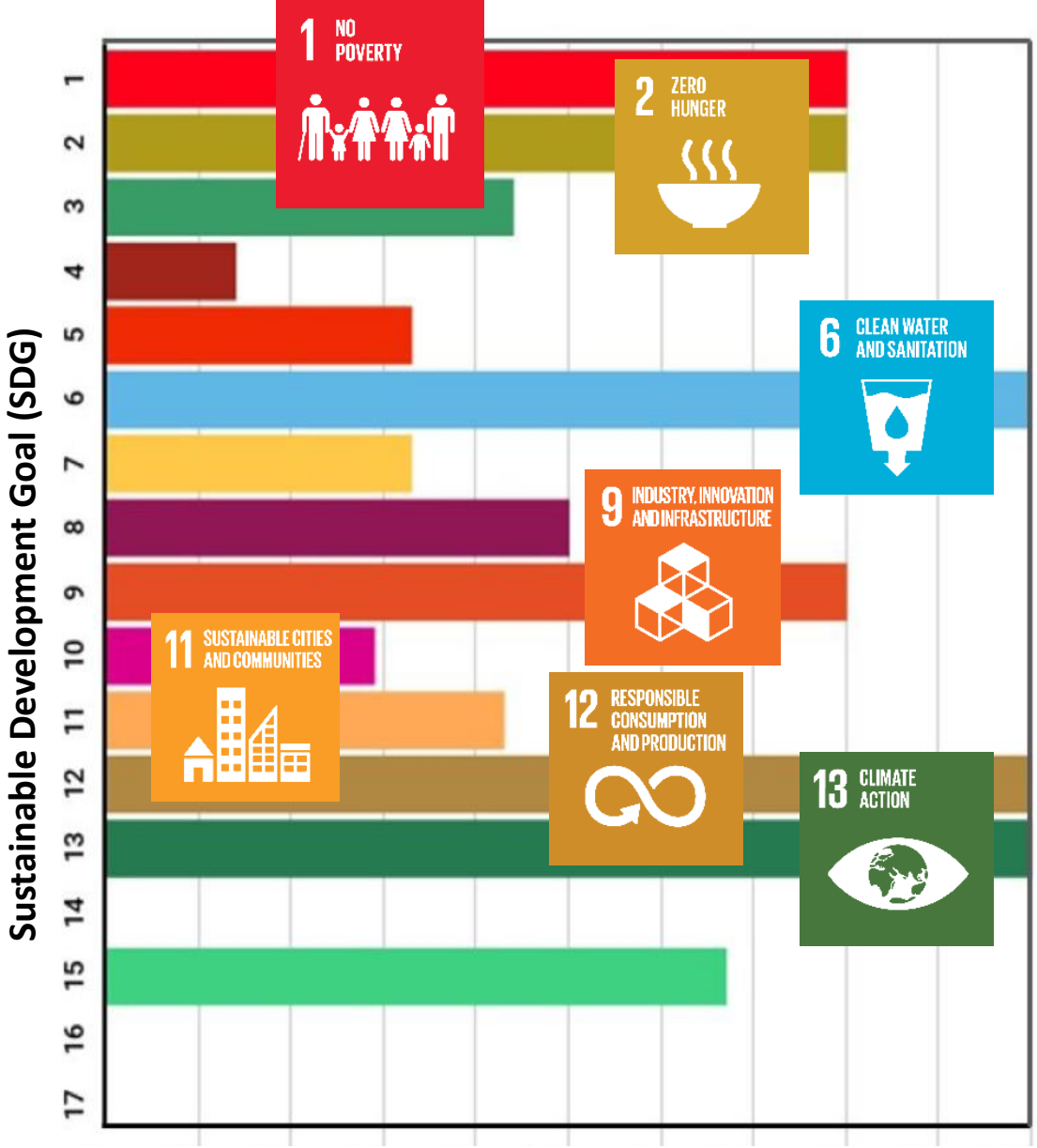
Taylor (2014)

Global groundwater abstraction

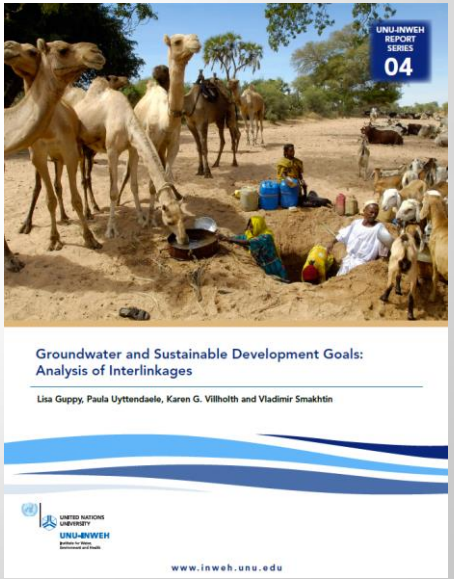


Source: Wada et al. 2010. ©2010 American Geophysical Union. Reproduced by permission of the American Geophysical Union.

van der Gun (2012)



Groundwater and SDG interlinkages

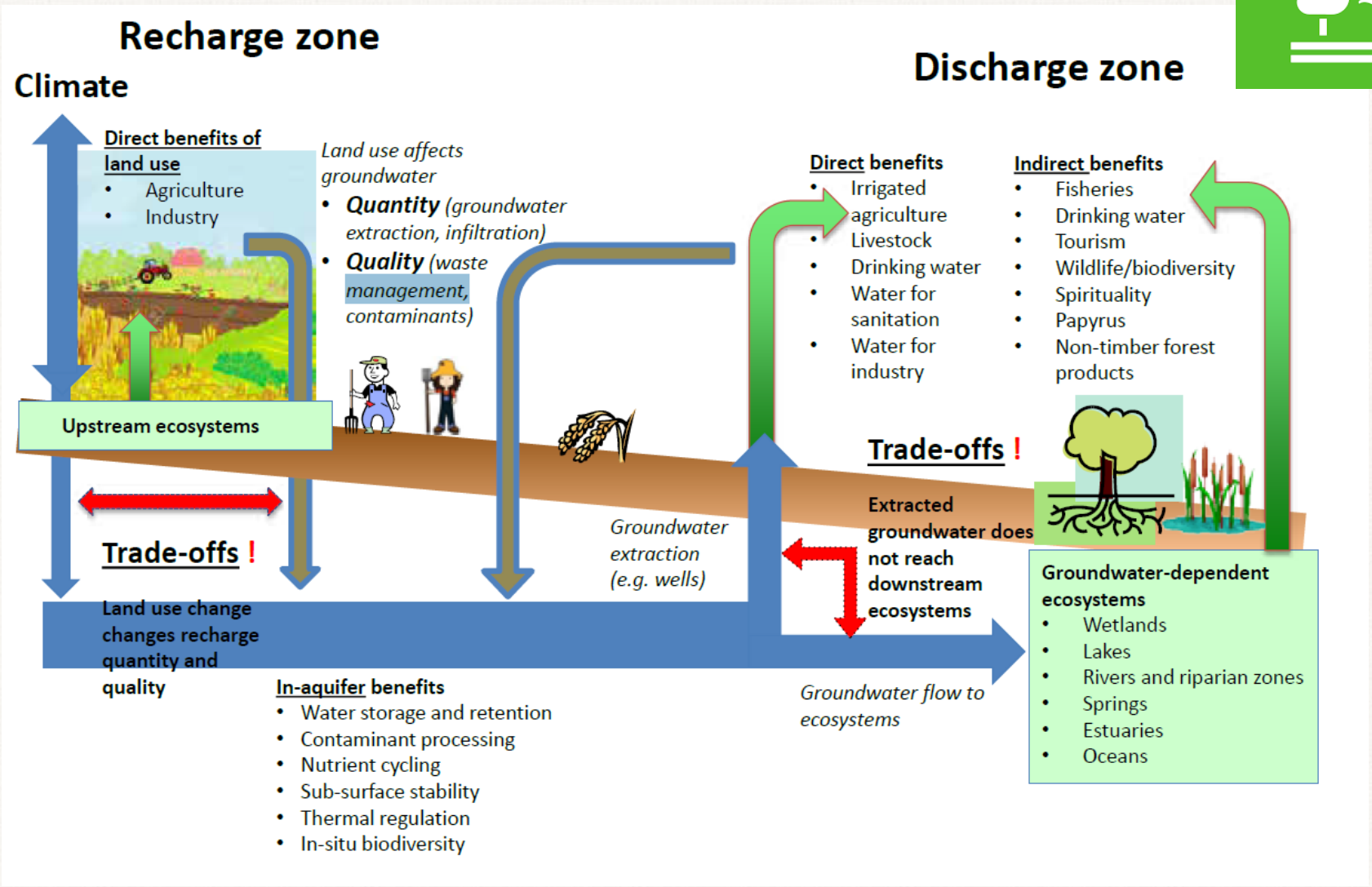


Guppy et al. (2018)

Drivers of groundwater development

- GW provides a reliable and suitable water source:
  - Often widely present
  - In-built distribution and storage
  - All-year availability and drought resilience
  - Individual access and management possible
  - Little loss from evaporation
  - Normally a safe source of drinking water
- Increasing demand for drinking water and food
- Better low-cost efficient pumps and wells
- Better knowledge on GW resources
- Increasing attention from governments, private sector and donors

Which trade-offs?



15 LIFE ON LAND

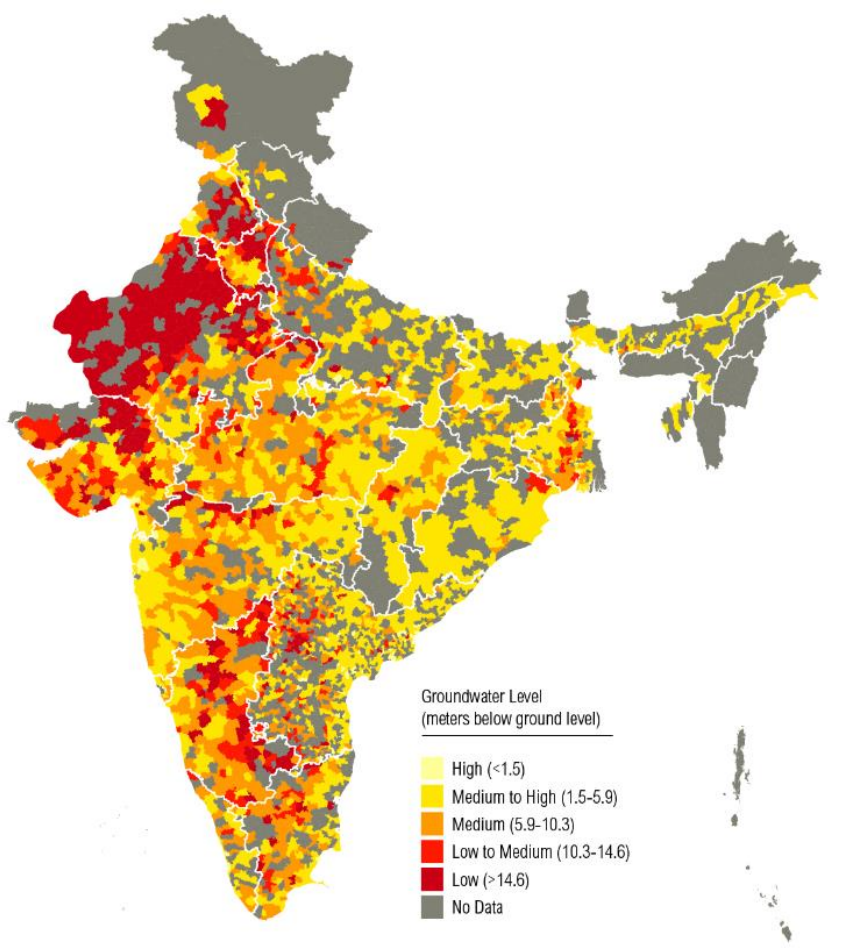
http://www.iwmi.cgiar.org/Publications/wle/corporate/groundwater_and_ecosystem_services_framework.pdf

Efficient groundwater irrigation next to the Limpopo River

- Sustainable?

2 ZERO HUNGER

Depletion in India



54% of India's groundwater wells are declining, up to more than 1 m per year

World Resources Institute: https://www.wri.org/blog/2015/02/3-maps-explain-india-s-growing-water-risks

Impacts of depleted aquifers

https://pulitzercenter.org/projects/vanishing-groundwater-aquifers-global-california-india-peru-morocco

Cost of groundwater depletion

- In the San Joaquin Valley, California, damages of subsidence from 1955 to 1972 were estimated to be $1.3 billion (2013 dollars)
- Total direct and indirect economic losses to California's agriculture of the drought for 2011 was estimated at $2.2 billion. Within that estimate, additional groundwater pumping costs are estimated to be $454 million
- **Degraded water quality from aquifer depletion** can reduce water supply, requiring alternative supplies, and cause health problems
- **Increased food prices** are expected from higher energy costs and reduced water reliability

http://waterinthewest.stanford.edu/groundwater/overdraft/

Challenges of groundwater management

- Difficult to control the use, and make users comply with regulations and restrictions in use
- Difficult to determine/decide the sustainable use
- Groundwater problems are often associated with land use
- Groundwater impacts are slow to appear and slow to remediate
- Groundwater dependence is difficult to reverse

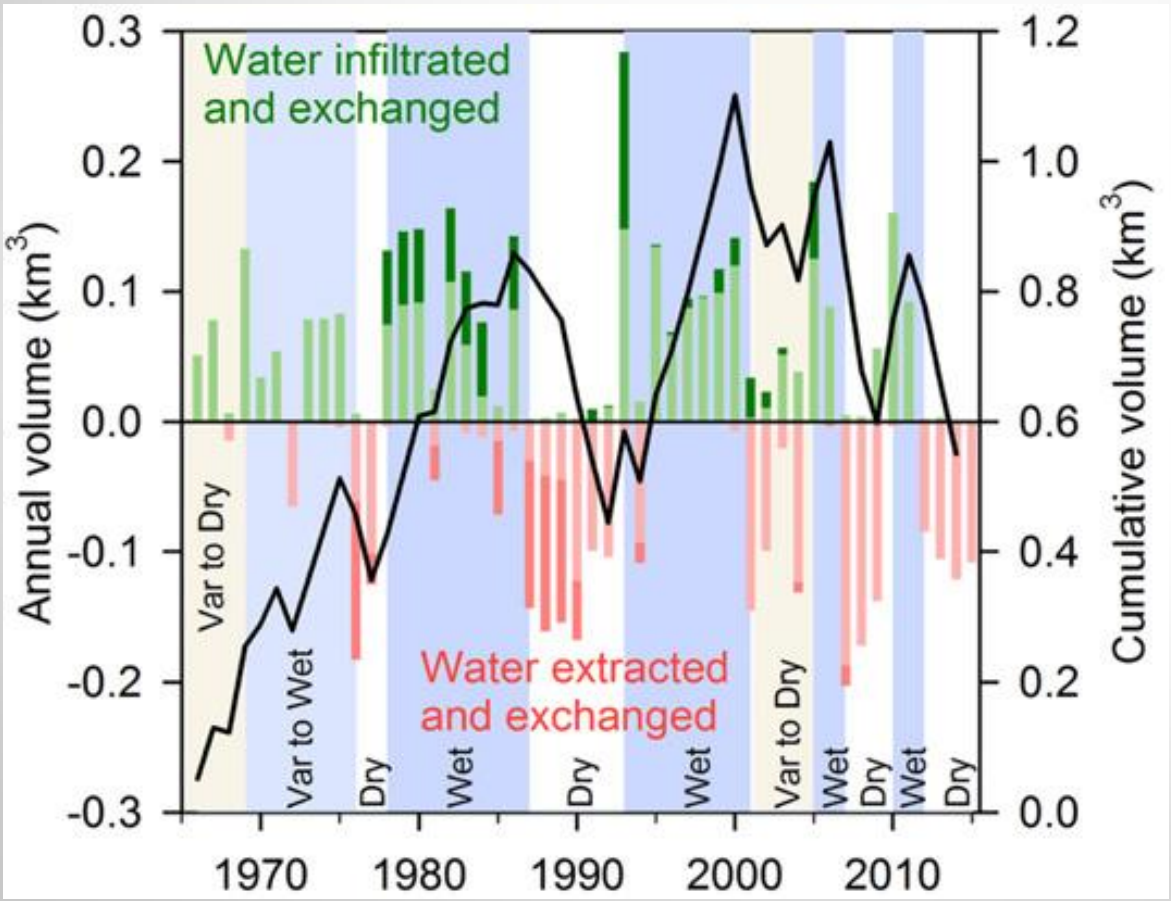
Approaches to sustainable groundwater management

- 'The only way to manage groundwater is to make it very costly to use'
- 'The only way to control the overuse of groundwater is for the government to introduce a strict licensing system'
- 'Aquifer associations and community groundwater management are the only real solution'
- 'The only way to manage groundwater is to have accurate and up-to-date information on groundwater resources as well as proper monitoring systems'
- Groundwater use is controlled indirectly through food end energy policies

Climate change impacts on groundwater

- In arid areas, impacts of climate change on groundwater uncertain
- Most vulnerable areas: Arid areas, big coastal cities, large tropical deltas, small islands
- Groundwater is a drought adaptation strategy but only to a certain extent
- Groundwater over-abstraction and flooding can occur at the same time
- Energy intricately linked to groundwater exploitation
- In areas with increased precipitation, like Denmark, groundwater levels are rising

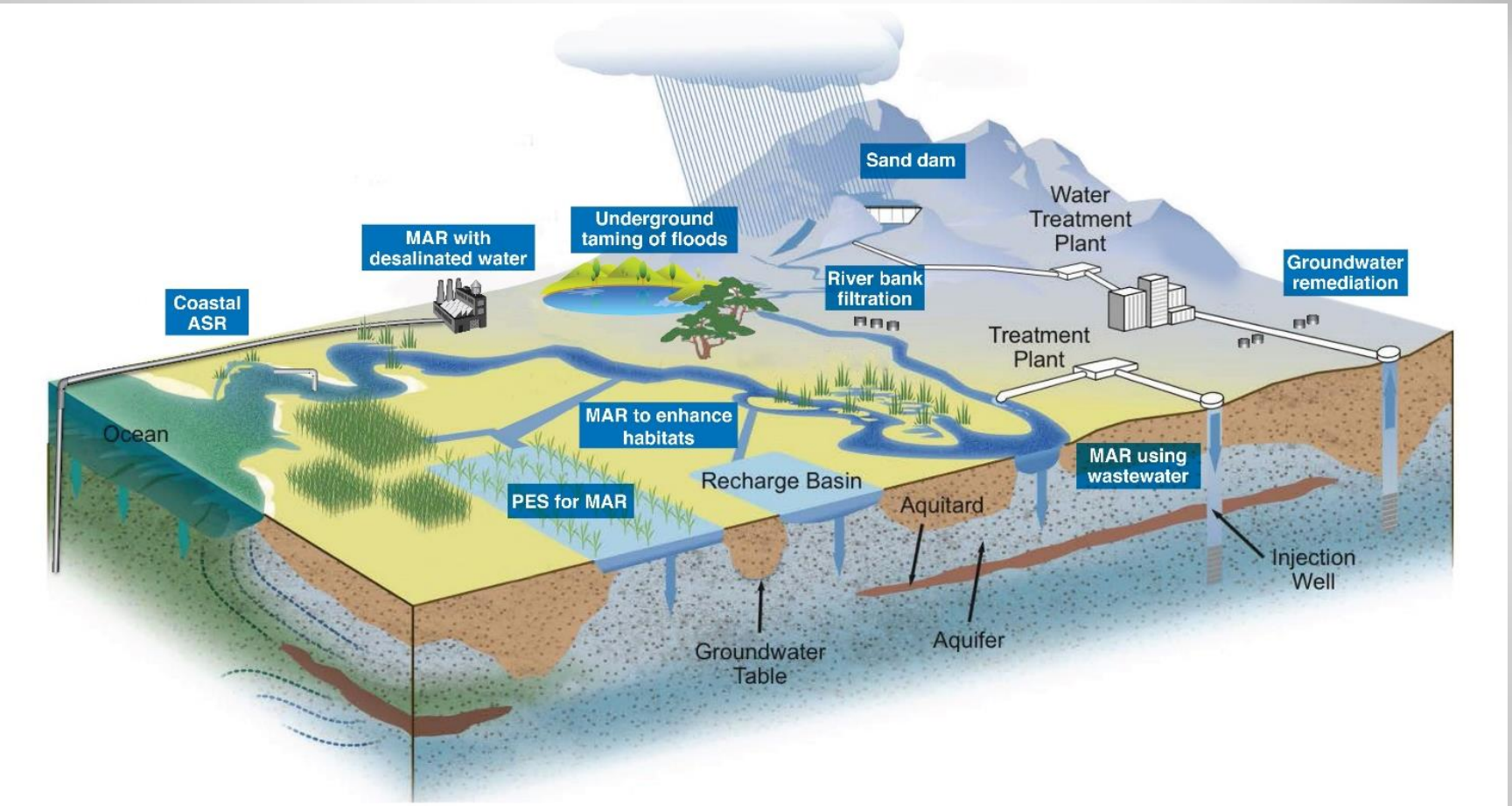
Double trouble – Groundwater during drought



Scanlon et al. (2016)

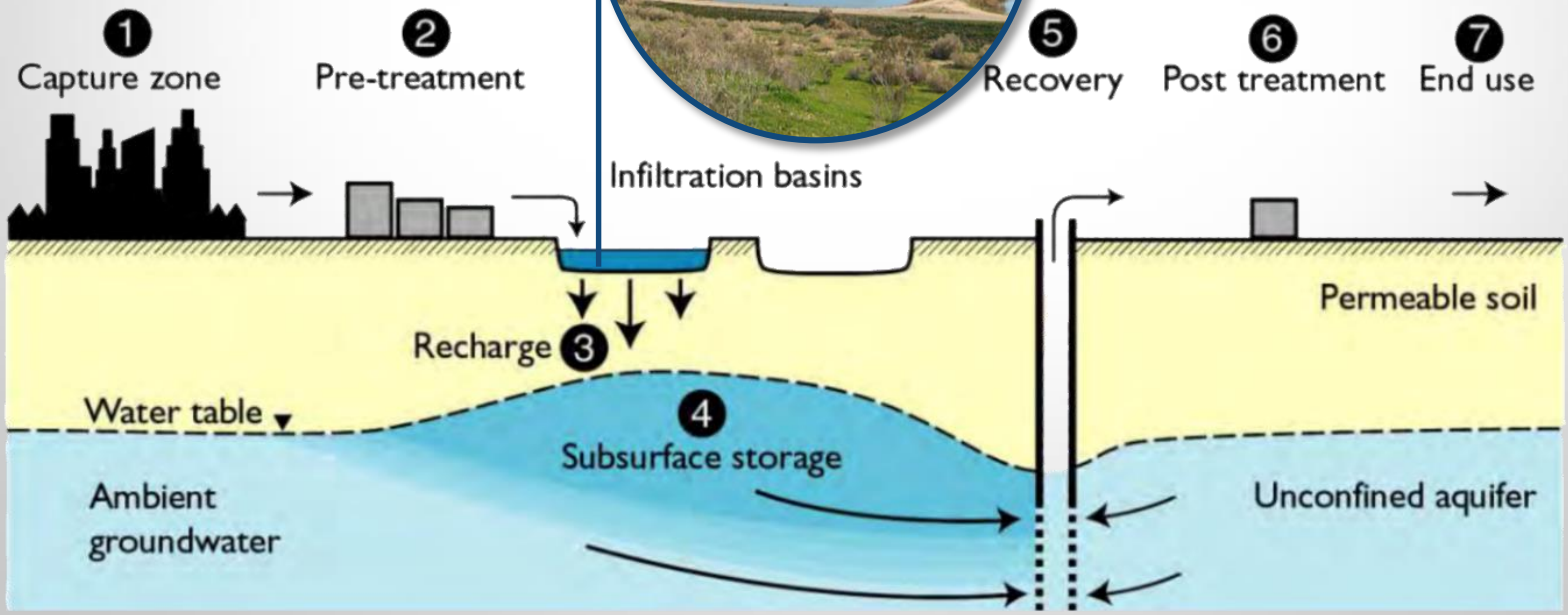
Groundwater-Based Natural Infrastructure

9 INDUSTRY, INNOVATION AND INFRASTRUCTURE



http://gripp.iwmi.org/natural-infrastructure/

Circular economy
- Managed Aquifer Recharge



Dillon et al. (2009)

Smart water metering and smart cards, China

- In Minqin, quotas have successfully affected farmers' groundwater use practices
- In Guazhou, water pricing has had little impact on farmers' individual groundwater use practices
- The case of Minqin exemplifies that quotas enable equitable water access to all farmers and maintain the buffer function of conjunctive surface water and groundwater use

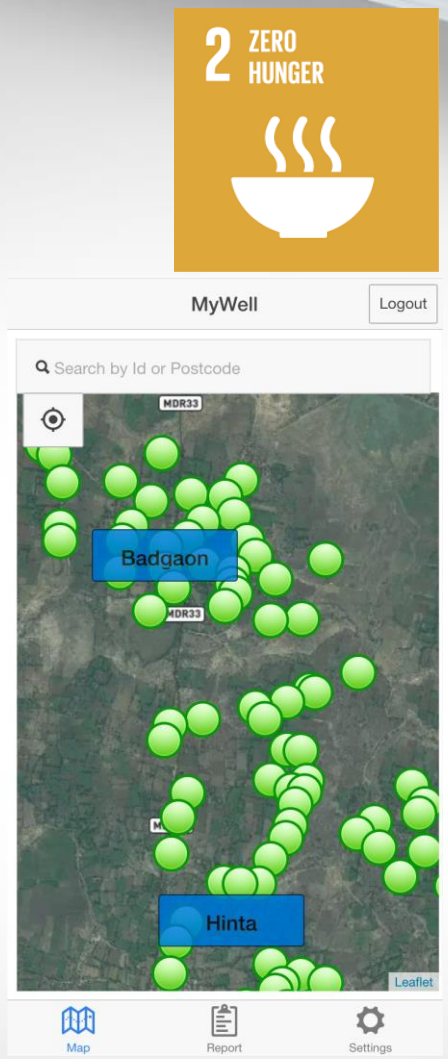
http://gripp.iwmi.org/2017/12/21/gripp-case-profile-series-issue-2/

Southern Colorado case

‘It seems stupid to actually tax yourselves and cost yourself more money," Messick says. "But the big picture is you stay in business, you keep your community whole and everybody gives a little.’

https://www.npr.org/sections/thesalt/2017/11/18/562912732/to-save-their-water-supply-colorado-farmers-taxed-themselves?t=1556724394170

Citizen science



http://www.marvi.org.in/

Solar powered irrigation - business models

1: On grid: SPICE – Dhundi, Gujarat, India

3: Off grid: Micro-irrigation – Ethiopia/Ghana, Africa

2: Off grid: Irrigation Service Provider (ISP Model)– Bihar, India

4: Decentralized grid: Solar Irrigation + Home enterprise

Water footprint

12 RESPONSIBLE CONSUMPTION AND PRODUCTION

1kg of beef

10 TO 20,000 LITRES

depending on the production region, feed composition, and origin of the feed ingredients

One pint of beer

160 LITRES

One pair of leather shoes

8,000 LITRES

One cup of black coffee without sugar

140 LITRES

One cotton shirt

2,900 LITRES

The sugar in one can of cola

200 LITRES

Groundwater is becoming a global concern

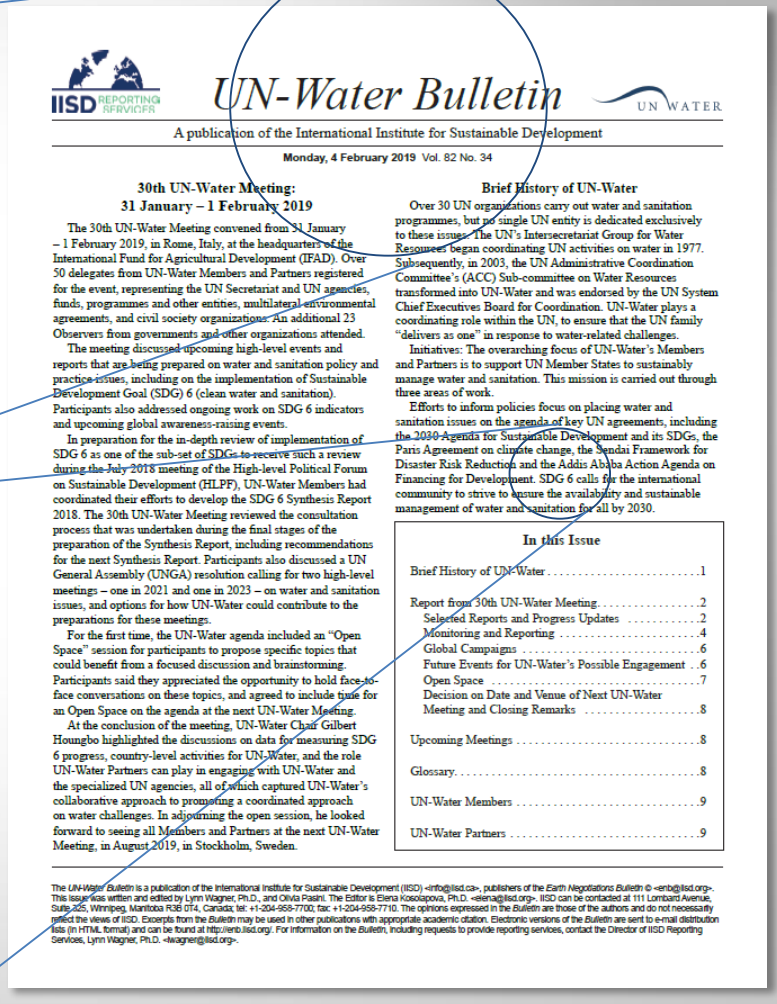
UN-Water Bulletin

Volume 82 Number 34 | Monday, 4 February 2019

30th UN-Water Meeting

31 January - 1 February 2019 | Rome, Italy

Decision: UN-Water decides "Valuing Water" as the theme for World Water Day 2021, and "**Groundwater: making the invisible visible" as the theme for World Water Day 2022.**



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UN-Water Bulletin

UN WATER

A publication of the International Institute for Sustainable Development

Monday, 4 February 2019 Vol. 82 No. 34

30th UN-Water Meeting: 31 January – 1 February 2019

The 30th UN-Water Meeting convened from 31 January – 1 February 2019, in Rome, Italy, at the headquarters of the International Fund for Agricultural Development (IFAD). Over 50 delegates from UN-Water Members and Partners registered for the event, representing the UN Secretariat and UN agencies, funds, programmes and other entities, multilateral environmental agreements, and civil society organizations. An additional 23 Observers from governments and other organizations attended.

The meeting discussed upcoming high-level events and reports that are being prepared on water and sanitation policy and practice issues, including on the implementation of Sustainable Development Goal (SDG) 6 (clean water and sanitation). Participants also addressed ongoing work on SDG 6 indicators and upcoming global awareness-raising events.

In preparation for the in-depth review of implementation of SDG 6 as one of the sub-set of SDGs to receive such a review during the July 2018 meeting of the High-level Political Forum on Sustainable Development (HLPF), UN-Water Members had coordinated their efforts to develop the SDG 6 Synthesis Report 2018. The 30th UN-Water Meeting reviewed the consultation process that was undertaken during the final stages of the preparation of the Synthesis Report, including recommendations for the next Synthesis Report. Participants also discussed a UN General Assembly (UNGA) resolution calling for two high-level meetings – one in 2021 and one in 2023 – on water and sanitation issues, and options for how UN-Water could contribute to the preparations for these meetings.

For the first time, the UN-Water agenda included an "Open Space" session for participants to propose specific topics that could benefit from a focused discussion and brainstorming. Participants said they appreciated the opportunity to hold face-to-face conversations on these topics, and agreed to include time for an Open Space on the agenda at the next UN-Water Meeting.

At the conclusion of the meeting, UN-Water Chair Gilbert Houngbo highlighted the discussions on data for measuring SDG 6 progress, country-level activities for UN-Water, and the role UN-Water Partners can play in engaging with UN-Water and the specialized UN agencies, all of which captured UN-Water's collaborative approach to promoting a coordinated approach on water challenges. In adjourning the open session, he looked forward to seeing all Members and Partners at the next UN-Water Meeting, in August 2019, in Stockholm, Sweden.

Brief History of UN-Water

Over 30 UN organizations carry out water and sanitation programmes, but no single UN entity is dedicated exclusively to these issues. The UN's Intersecretariat Group for Water Resources began coordinating UN activities on water in 1977. Subsequently, in 2003, the UN Administrative Coordination Committee's (ACC) Sub-committee on Water Resources transformed into UN-Water and was endorsed by the UN System Chief Executives Board for Coordination. UN-Water plays a coordinating role within the UN, to ensure that the UN family "delivers as one" in response to water-related challenges.

Initiatives: The overarching focus of UN-Water's Members and Partners is to support UN Member States to sustainably manage water and sanitation. This mission is carried out through three areas of work.

Efforts to inform policies focus on placing water and sanitation issues on the agenda of key UN agreements, including the 2030 Agenda for Sustainable Development and its SDGs, the Paris Agreement on climate change, the Sendai Framework for Disaster Risk Reduction and the Addis Ababa Action Agenda on Financing for Development. SDG 6 calls for the international community to strive to ensure the availability and sustainable management of water and sanitation for all by 2030.

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The *UN-Water Bulletin* is a publication of the International Institute for Sustainable Development (IISD) <info@iisd.ca>, publishers of the *Earth Negotiations Bulletin* © <enb@iisd.org>. This issue was written and edited by Lynn Wagner, Ph.D., and Olivia Pasini. The Editor is Elena Kosolapova, Ph.D. <elena@iisd.org>. IISD can be contacted at 111 Lombard Avenue, Suite 325, Winnipeg, Manitoba R3B 0T4, Canada; tel: +1-204-958-7700; fax: +1-204-958-7710. The opinions expressed in the *Bulletin* are those of the authors and do not necessarily reflect the views of IISD. Excerpts from the *Bulletin* may be used in other publications with appropriate academic citation. Electronic versions of the *Bulletin* are sent to e-mail distribution lists (in HTML format) and can be found at http://enb.iisd.org/. For information on the *Bulletin*, including requests to provide reporting services, contact the Director of IISD Reporting Services, Lynn Wagner, Ph.D. <lwagner@iisd.org>.

GRIPP

GROUNDWATER SOLUTIONS INITIATIVE FOR POLICY AND PRACTICE

GRIPP objective

Sustainable groundwater management for livelihoods, food security, climate resilience and economic growth

IWMI International Water Management Institute

GRIPP GROUNDWATER SOLUTIONS INITIATIVE FOR POLICY AND PRACTICE

http://gripp.iwmi.org/

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Craig Simmons, NCGRT
Director

Peter McCornick
Executive Director

GRIPP Core Group & Partners

Concluding remarks

- Groundwater underpins most SDGs, significantly SDG2 (food)
- This goal is increasingly compromising groundwater's fundamental role in basic water supply (SDG6), ecosystem services, climate change adaptation (SDG13), and health SDG3)
- Groundwater risks are now recognized as central to SDGs by key international organizations
- Still groundwater needs to be featured more strongly as part of the global and local change discourse and the risk management approaches
- Solutions require increasing efforts and investments at all levels, expert and inter-disciplinary capacity, governance and more effective partnerships (users, researchers, governments, international org's, private sector) to safeguard water and food security and socio-ecological systems underpinned by groundwater

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Thank You

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