IWMI International Water Management Institute

ONLINE CONFERENCE IWRA 2020

CGIAR RESEARCH PROGRAM ON Water, Land and Ecosystems

GRIPP GROUNDWATER SOLUTIONS INITIATIVE FOR POLICY AND PRACTICE

Groundwater in a Changing World - Buffer or Burnout?”

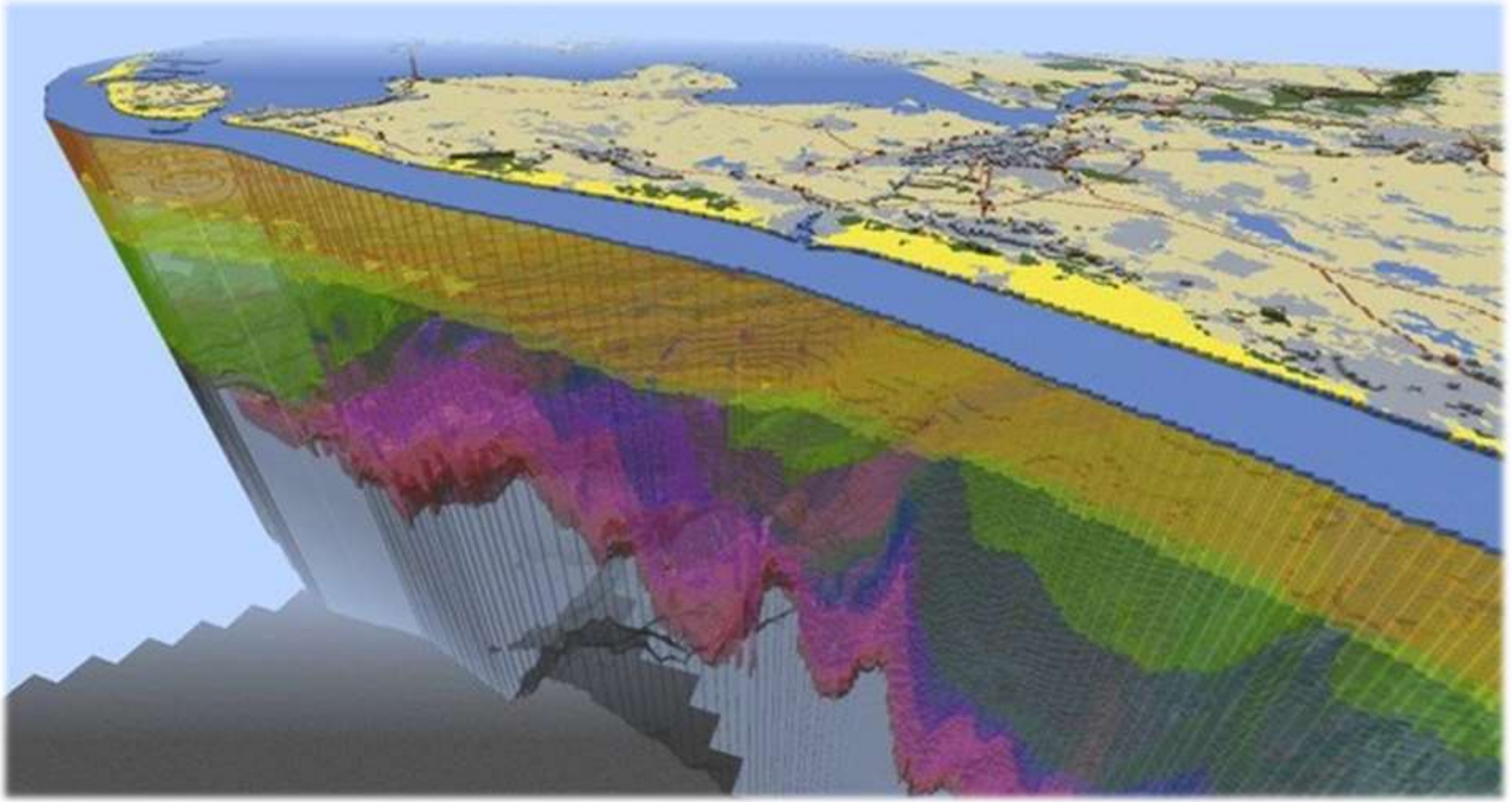
WRA Online Conference
Addressing Groundwater Resilience under Climate Change
28-30 October 2020

Karen G. Villholth
IWMI – International Water Management Institute

Outline

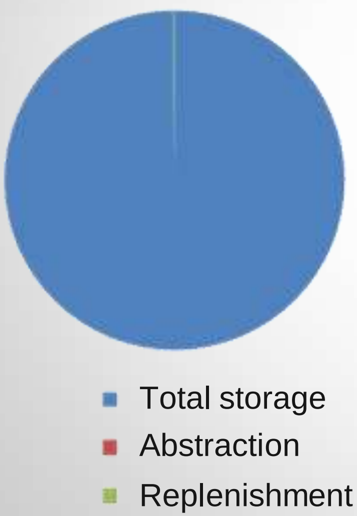
1. Groundwater – moving towards a buffer or burnout?
2. The quadrant of Climate Change impacts on groundwater
3. Adaptation – groundwater-based solutions
4. Some ways forward

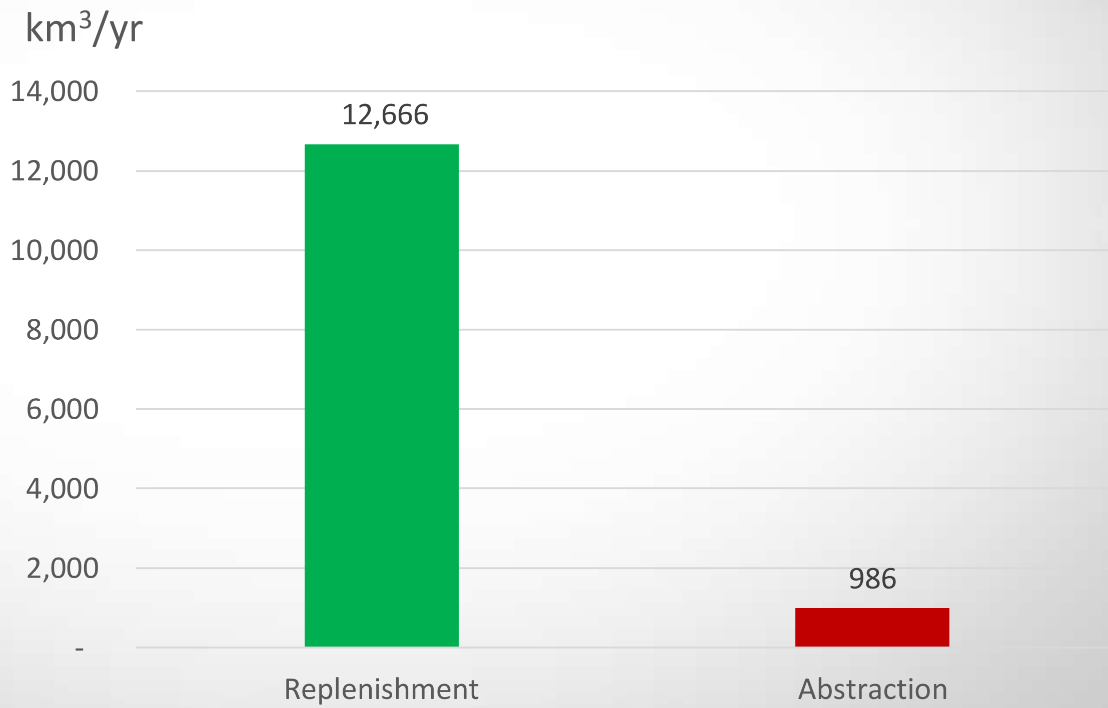
The world on its edge



The world on its edge

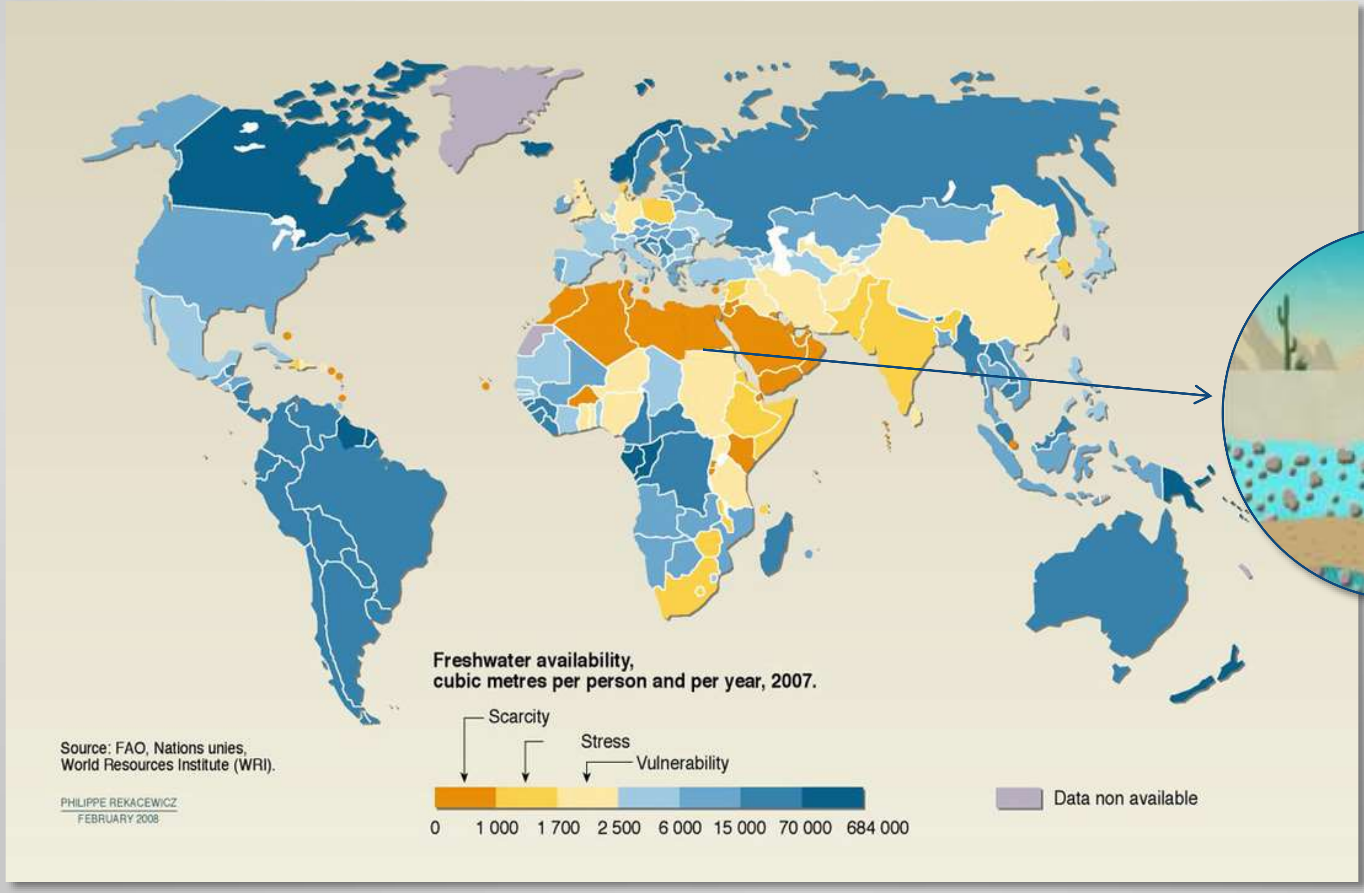
Renewable fresh groundwater resources

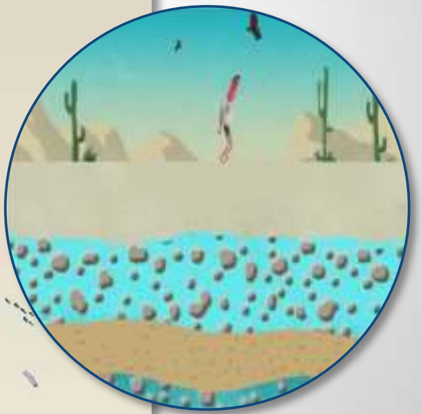




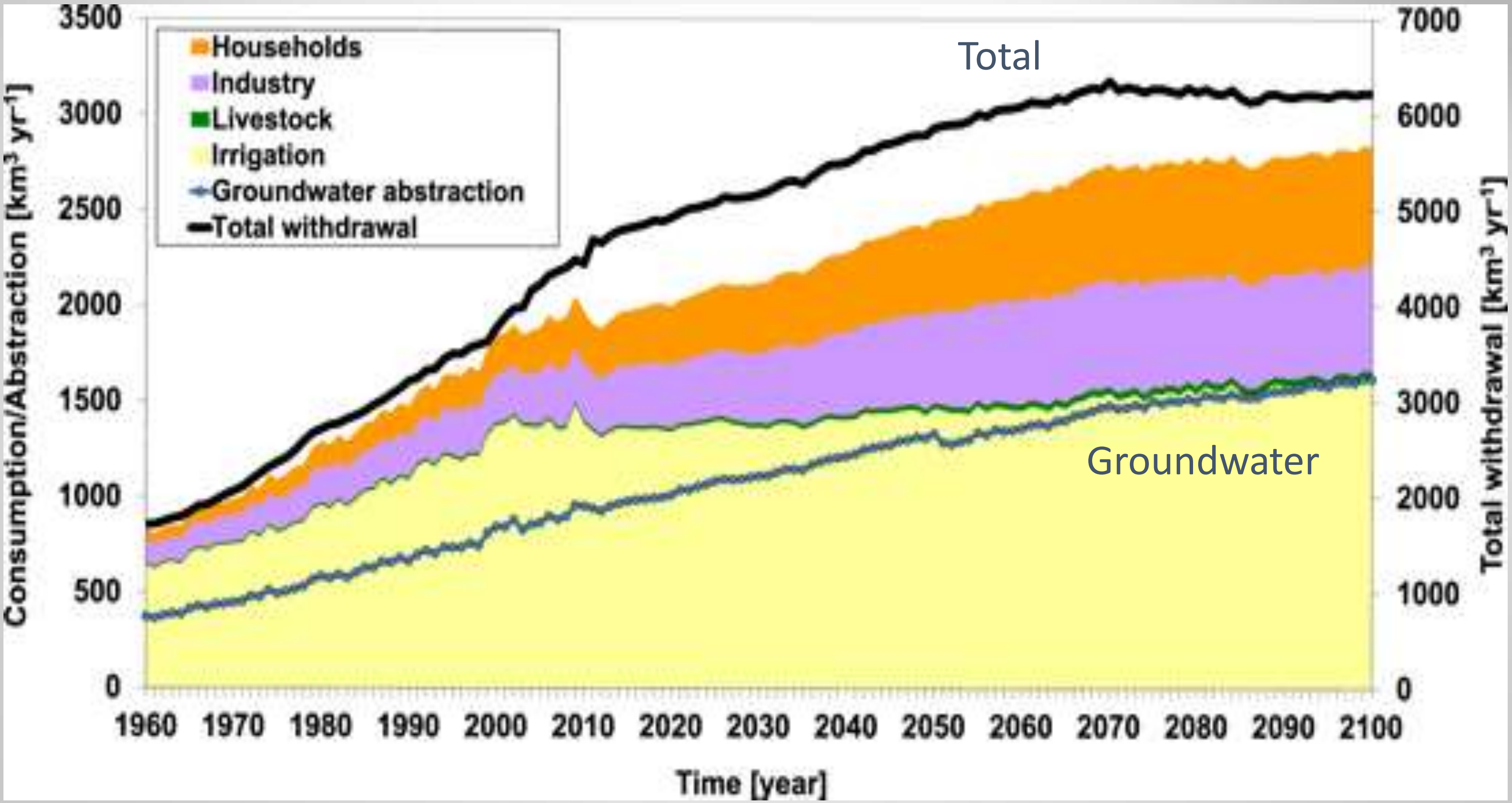
van der Gun (2012)

Global freshwater availability





Global groundwater abstraction



Wada and Bierkens (2014)

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

Climate change impacts on groundwater

- Groundwater provides resilience and a critical adaptation mechanism if well-managed
- In arid areas, GW recharge will be increasingly episodic and focused (Cuthbert et al, 2019)
- Most vulnerable areas: large coastal cities, tropical deltas, and small islands (due to seawater intrusion, subsidence and dense populations)
- In humid areas, like Denmark, groundwater levels are rising
- Groundwater depletion and flooding will co-exist

13 CLIMATE ACTION

Challenges

- Exact impacts are still not well understood
- Impacts on both quantity and quality important
- Groundwater is the ‘memory’ of climate, and so understanding groundwater in the context of climate (historic and future) is key
- Climate footprint on groundwater is increasingly confounded/overshadowed by human impact

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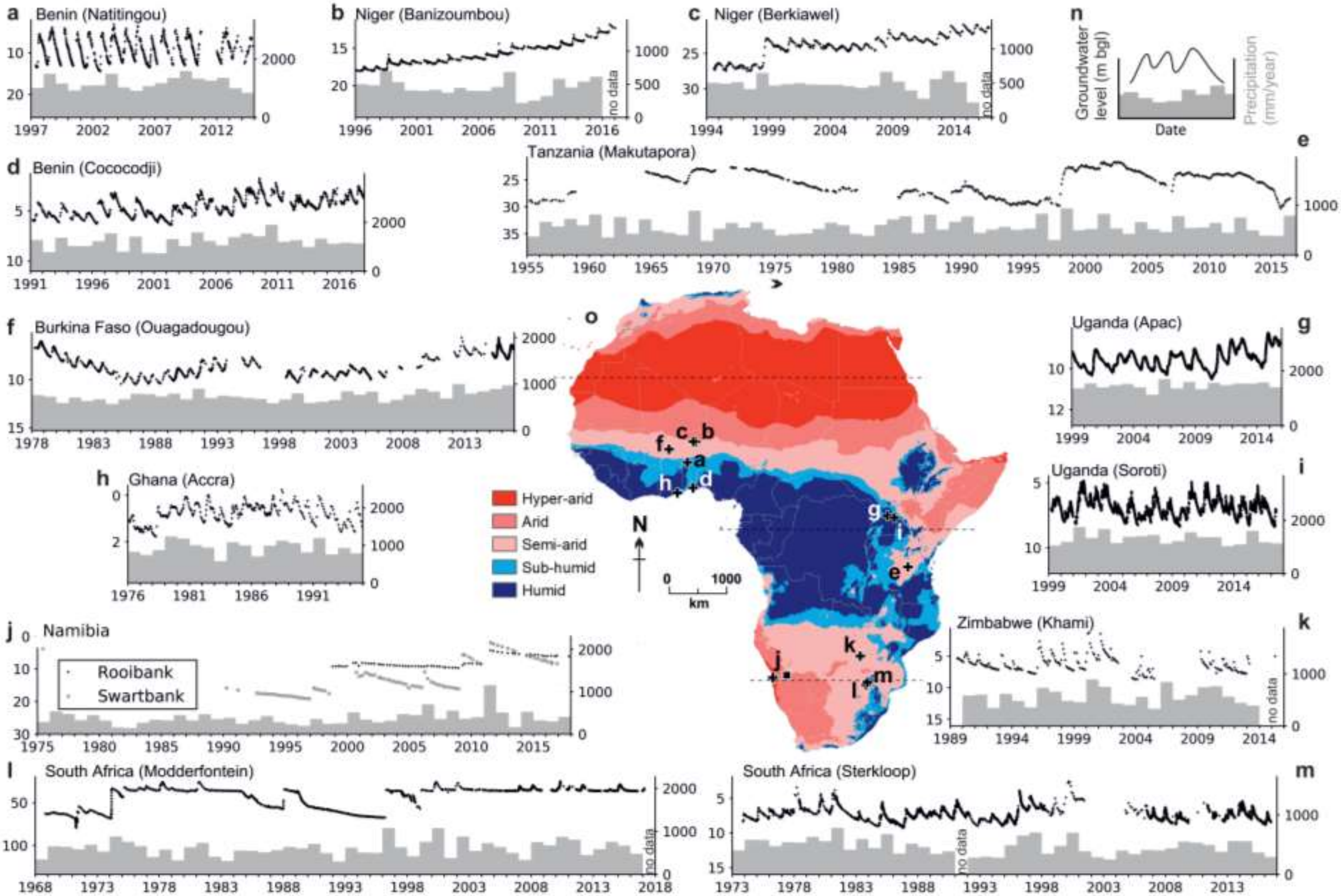
The quadrant of GW and Climate Change impacts

Water quantity	Direct	Indirect
Water quality	Direct	Indirect

Direct impact on GW quantity

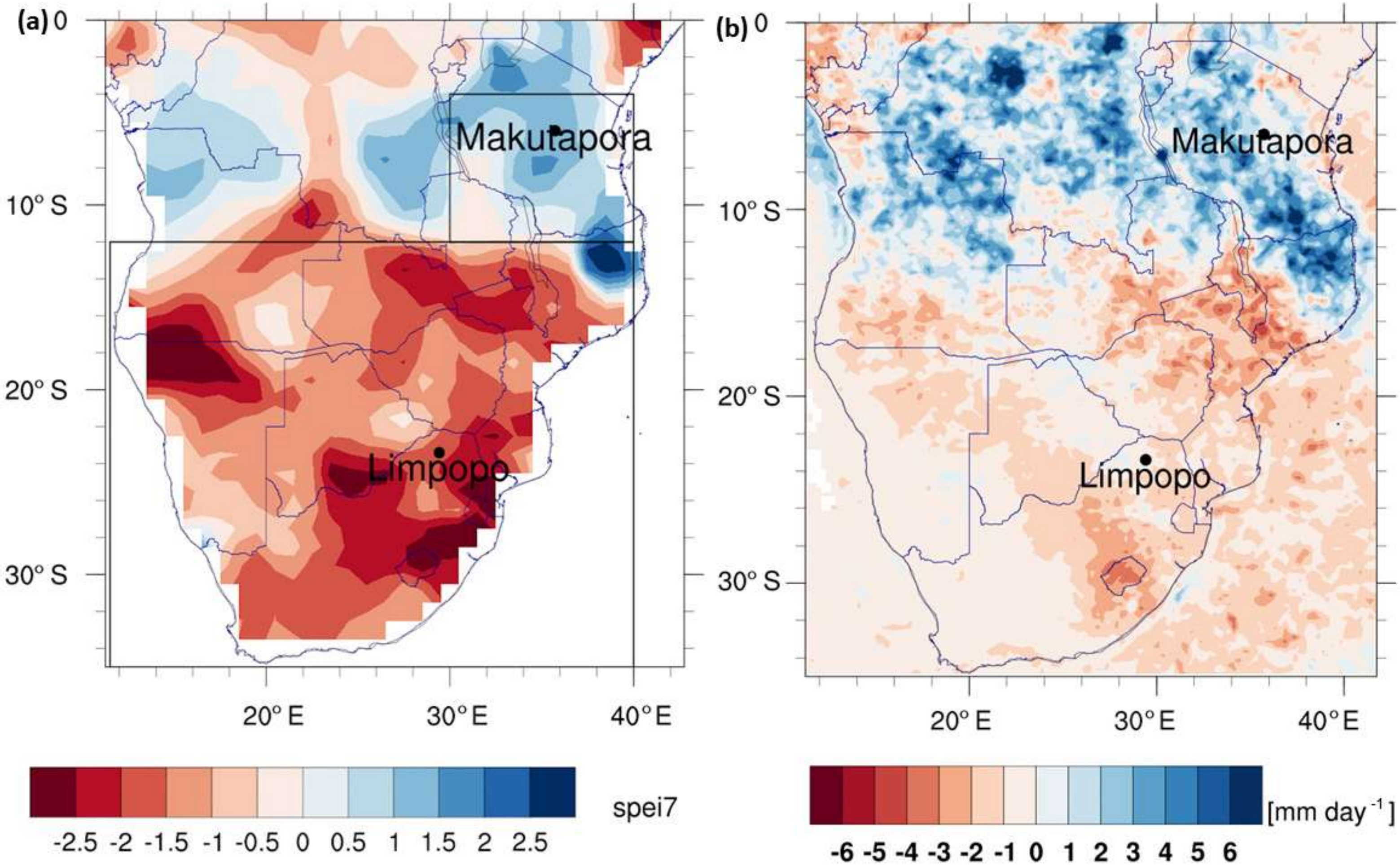
Water quantity	Direct	Indirect
Water quality	Direct	Indirect

Research in Sub-Saharan Africa



Cuthbert et al., 2019

Anomalies during El Niño event
2015-2016



Kolusu et al., 2019

Large-scale climate anomalies over the study region for Oct-Apr 2015–2016. (a) SPEI-7. (b) Anomalies of the 80th percentile of daily TRMM rainfall (mm day^{-1}).

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Indirect impact on GW quantity

Water quantity	Direct	Indirect
Water quality	Direct	Indirect

Indirect impact on GW quantity

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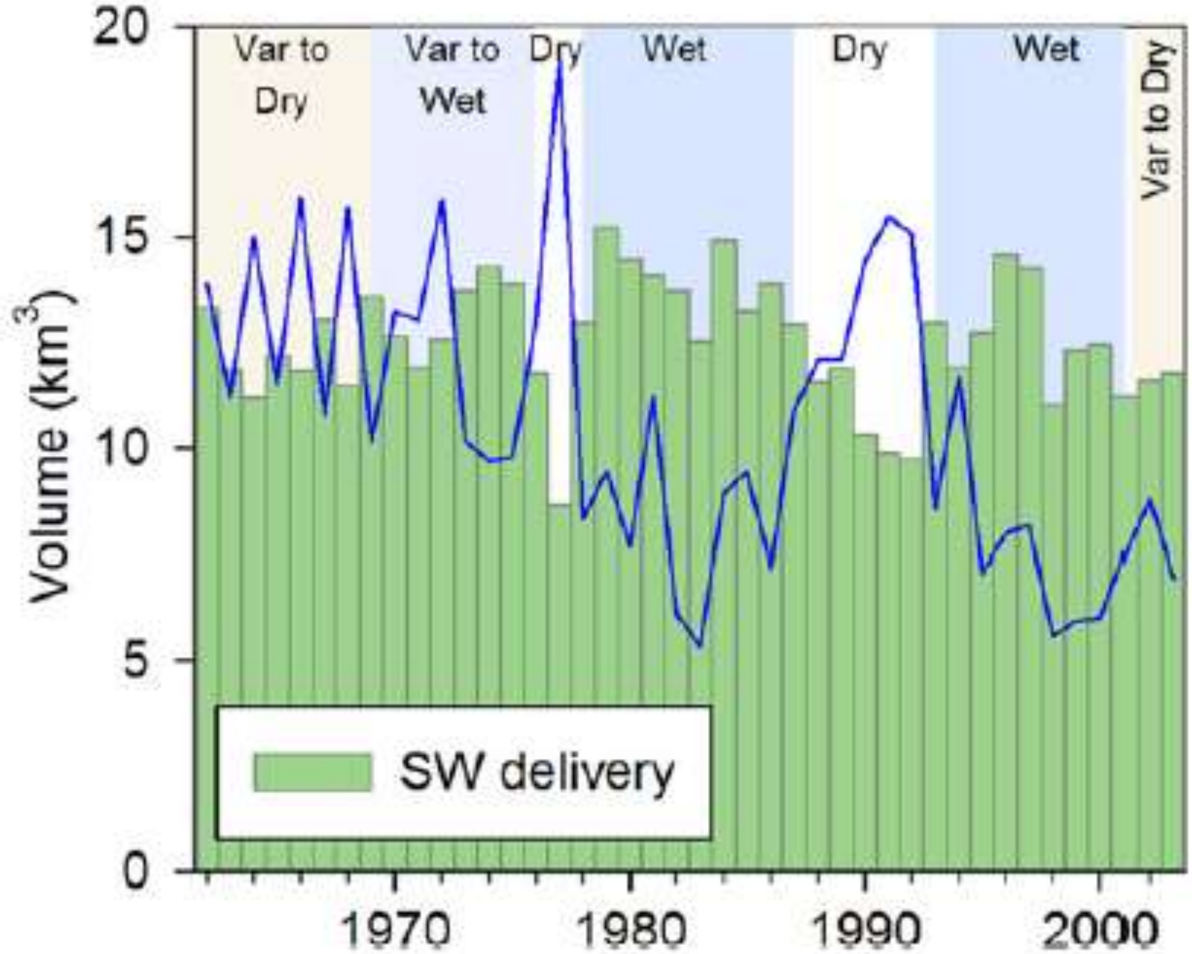
Indirect impact on GW quantity



Scanlon et al., 2016

Direct impact on GW quality

Water quantity	Direct	Indirect
Water quality	Direct	Indirect

Direct impact on GW quality

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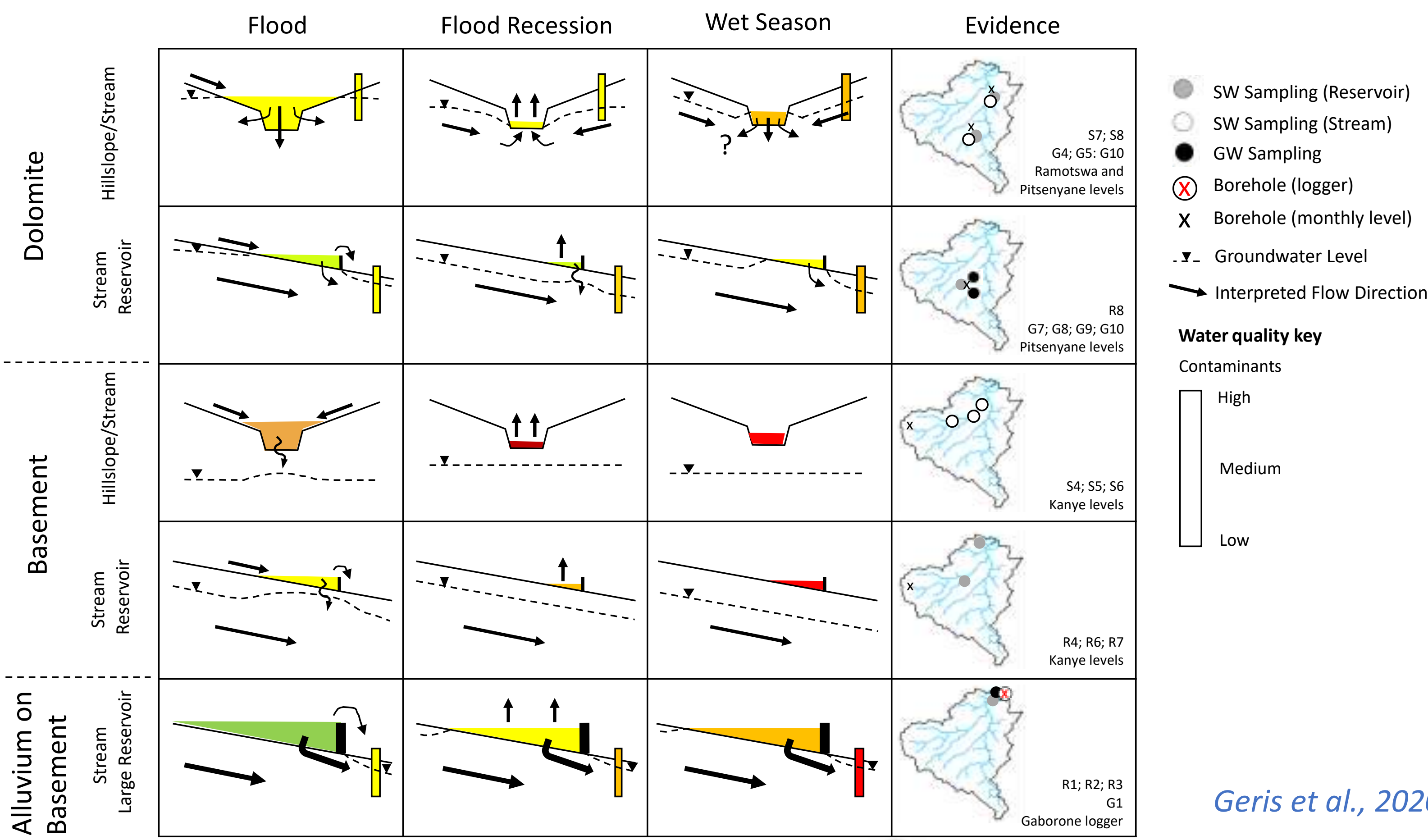
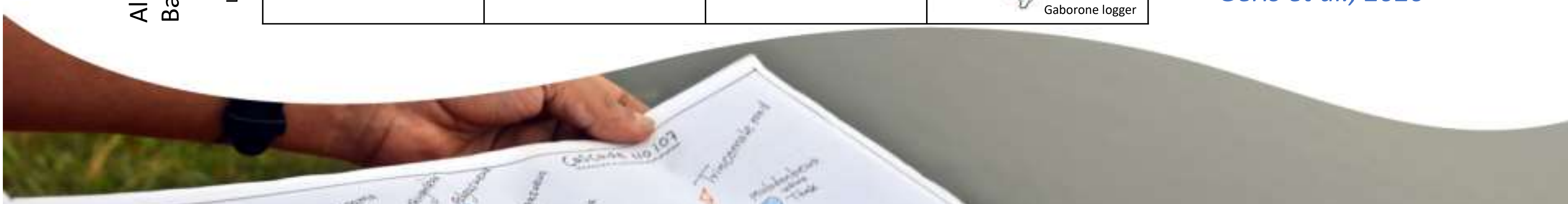
Contamination impacts from flooding in Botswana



Geris et al., 2020



Indirect impact on GW quality

Water quantity	Direct	Indirect
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Indirect impact on GW quality

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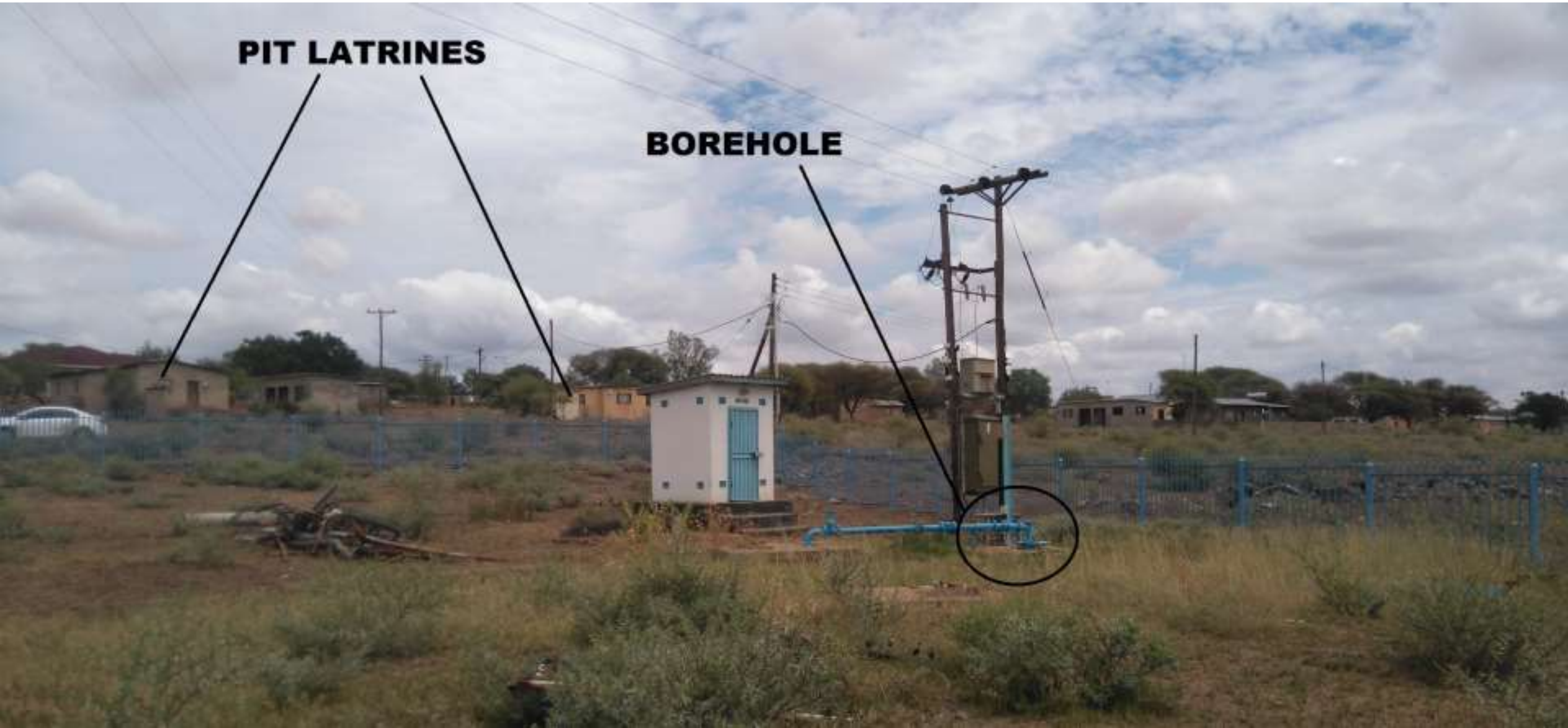
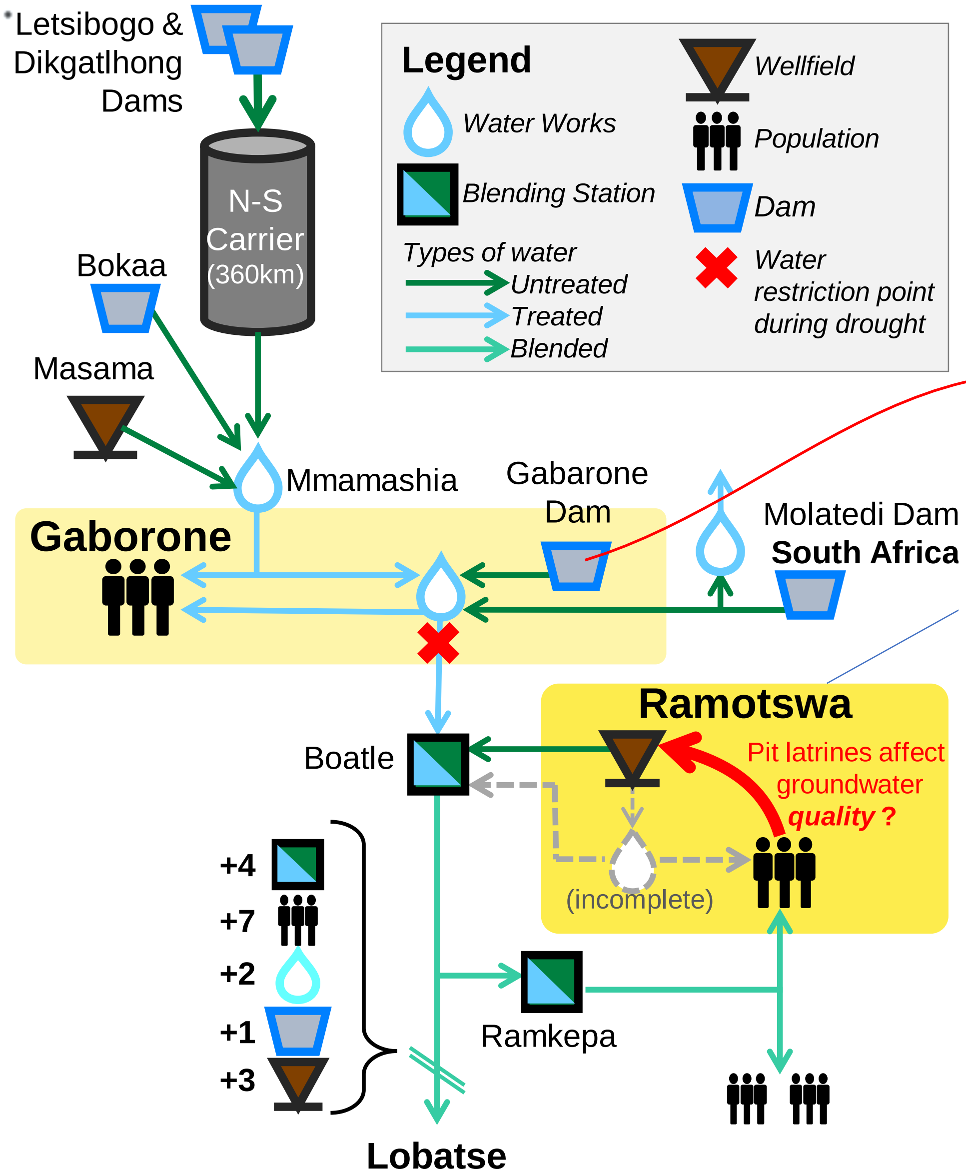
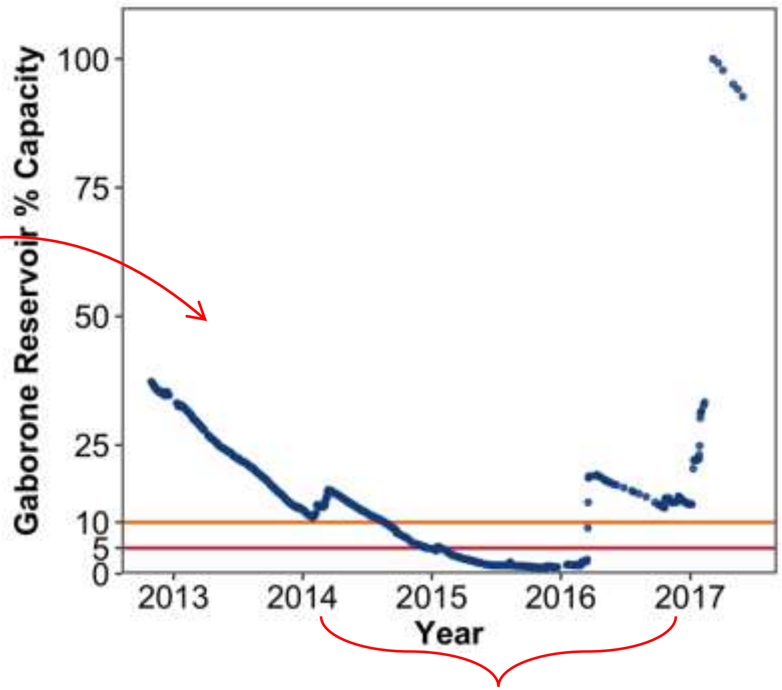
Climate change impacts on GW quality
Botswana case



Ramotswa water supply system

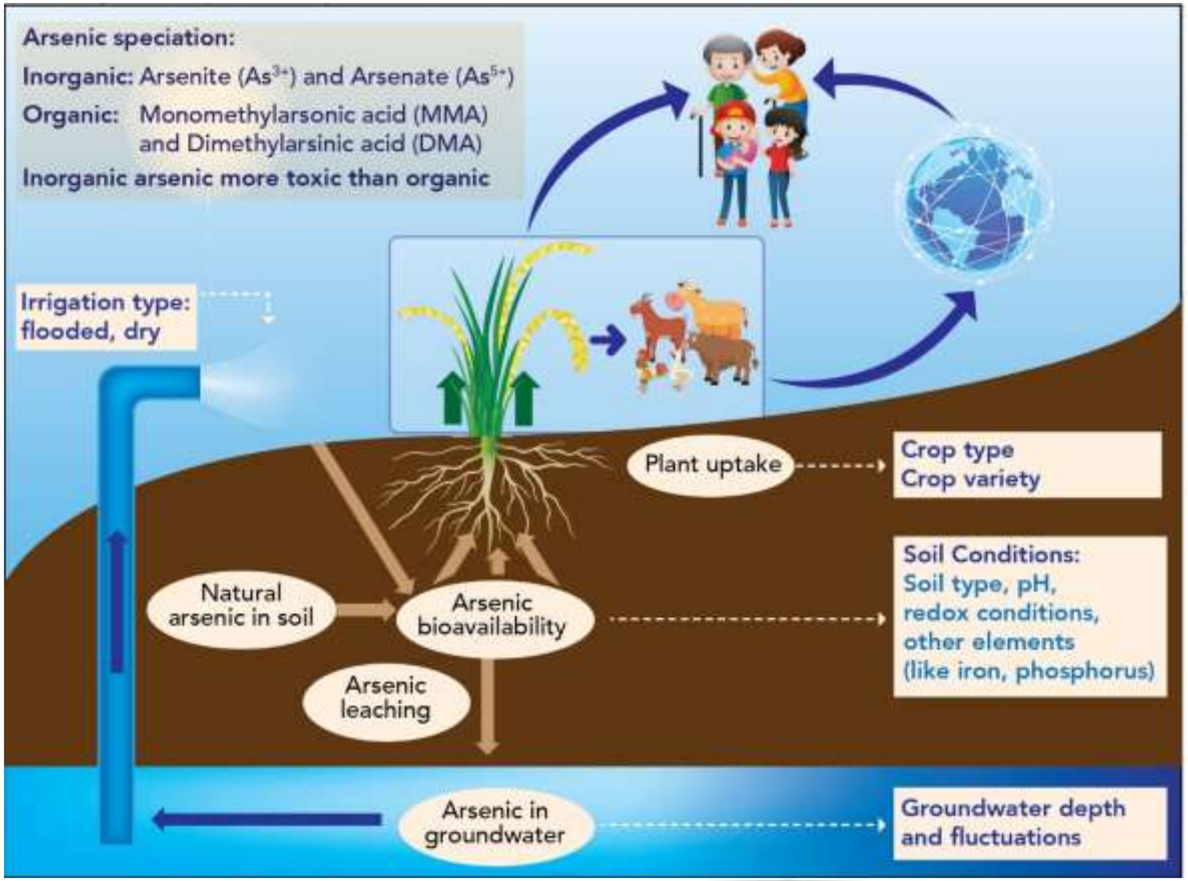




Water restrictions
=> no water to flush toilets

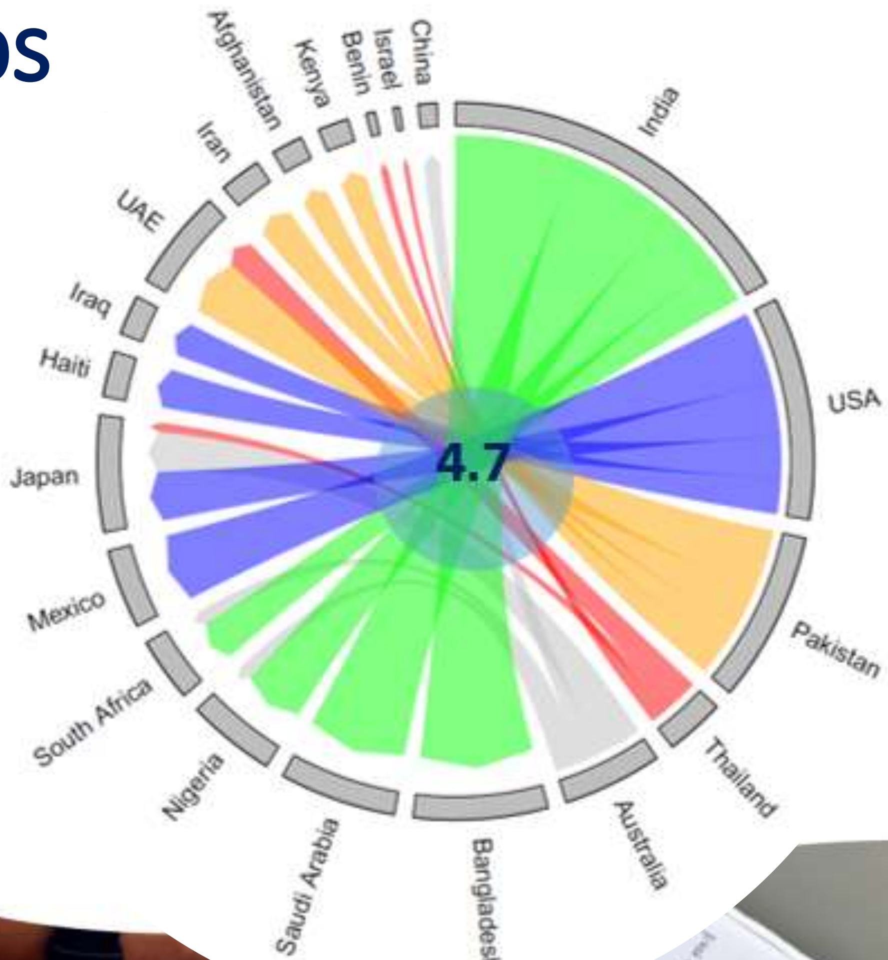
McGill et al., 2019

Human health risk propagation through food trade of arsenic in GW-irrigated crops



Alam et al., 2020

Human health risk propagation through food trade of arsenic in GW-irrigated crops

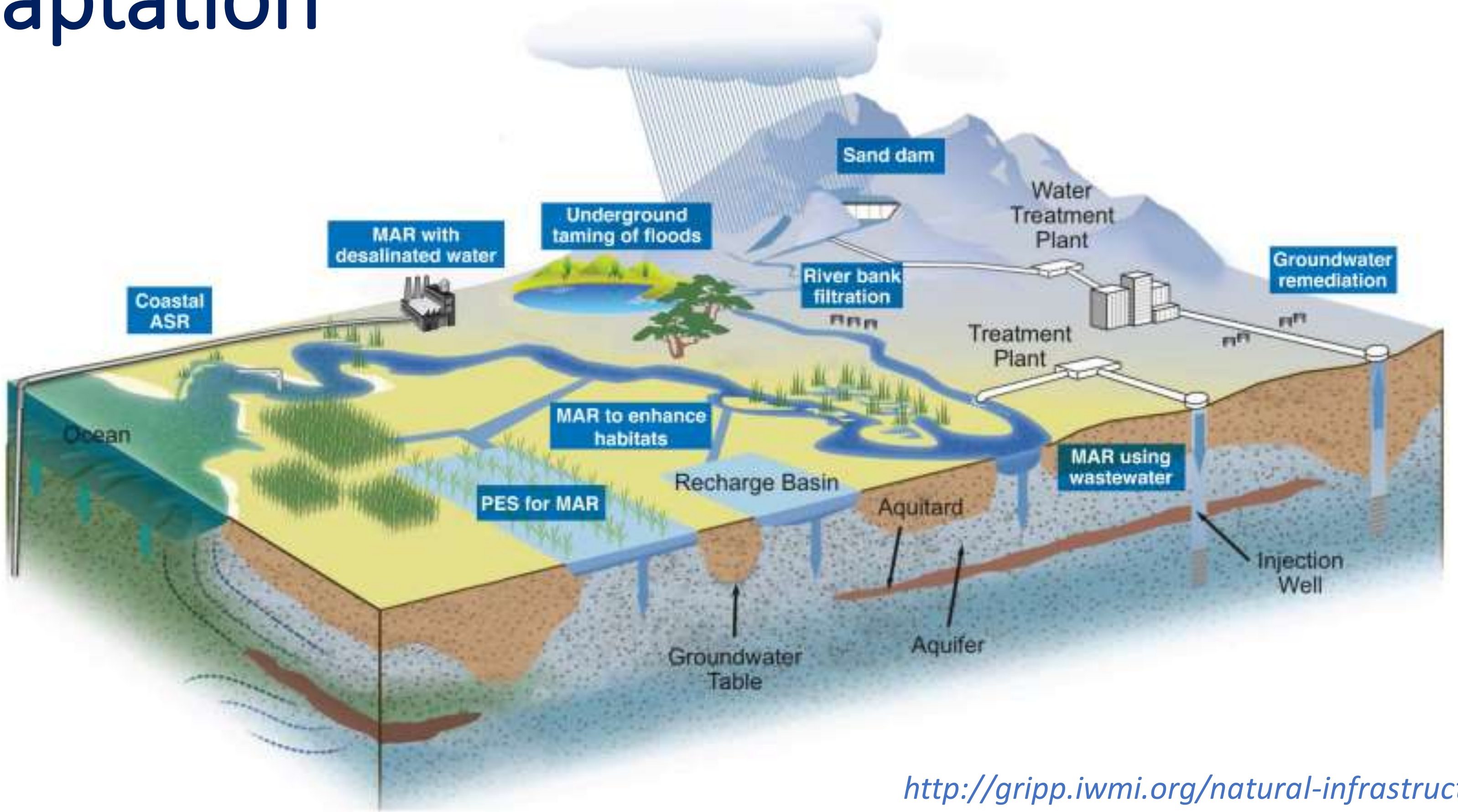


Currently, 4.7 MMT/yr of contaminated rice is traded globally, ~10.4% of global rice trade.

In future scenarios, the area grown under GW-irrigation in hazard areas may expand from 10.6 to 23.2 Mha.

Alam et al., 2020

Groundwater and climate change adaptation

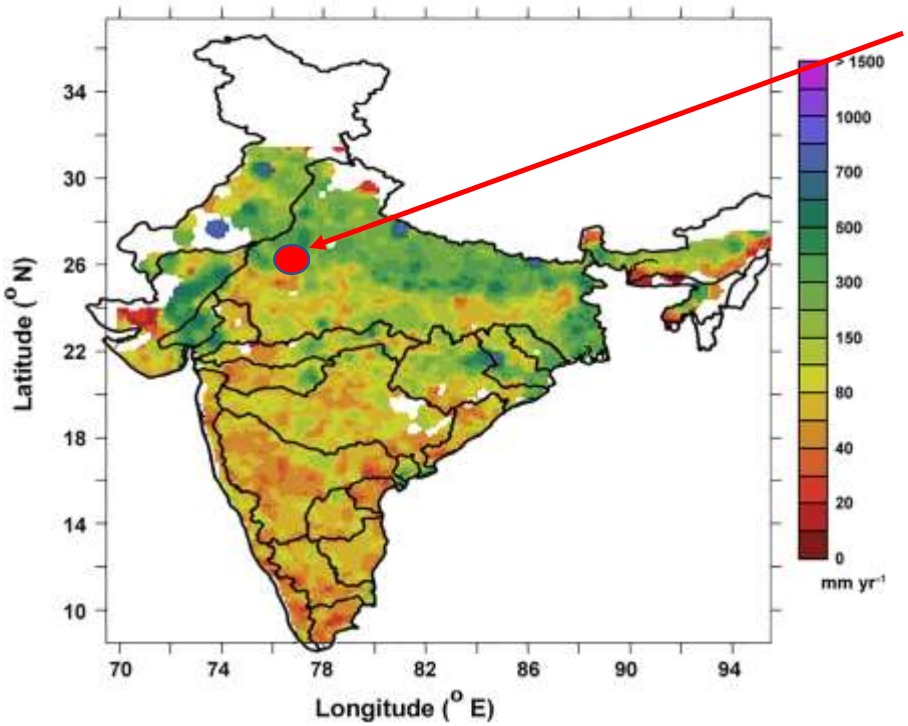


http://gripp.iwmi.org/natural-infrastructure/

Underground transfer of floods

Pavelic et al., 2020

Time to GW depletion reversal



Bhanja et al., 2019

Jaipur:

Recharge: 100 mm/year (*Bhanja et al., 2019)*

GW level decline (1995-2010): 21.6 m
(http://www.imedpub.com/articles/spatiotemporal-characteristics-of-ground-water-level-fluctuation-in-jaipur-urban-area-rajasthan-india.php?aid=10090)

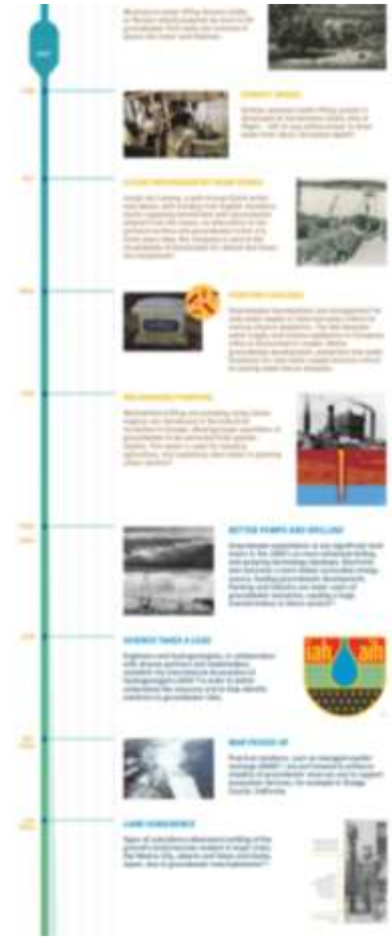
Average porosity: 0.4

Time to recover depleted aquifer: <u>86.4 years</u>

At India scale (*Sutanudjaja, 2019):*:

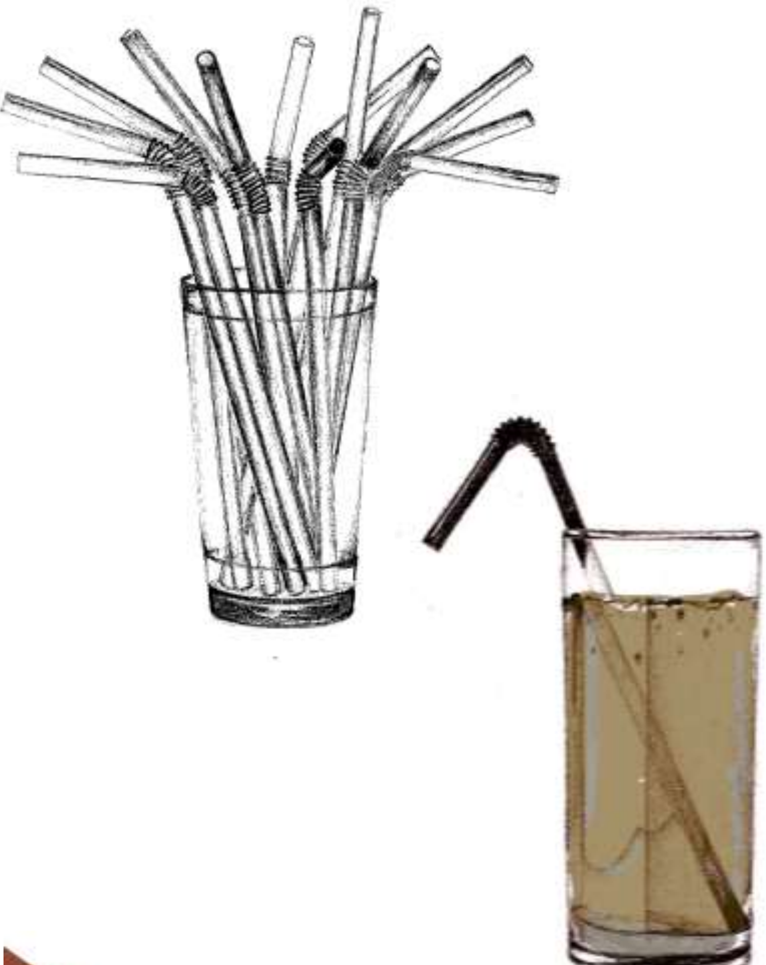
Recovery time: <u>9.6 years</u>

Possible ways forward



https://wle.cgiar.org/news/groundwater-future https://hdl.handle.net/10568/103496

Possible ways forward



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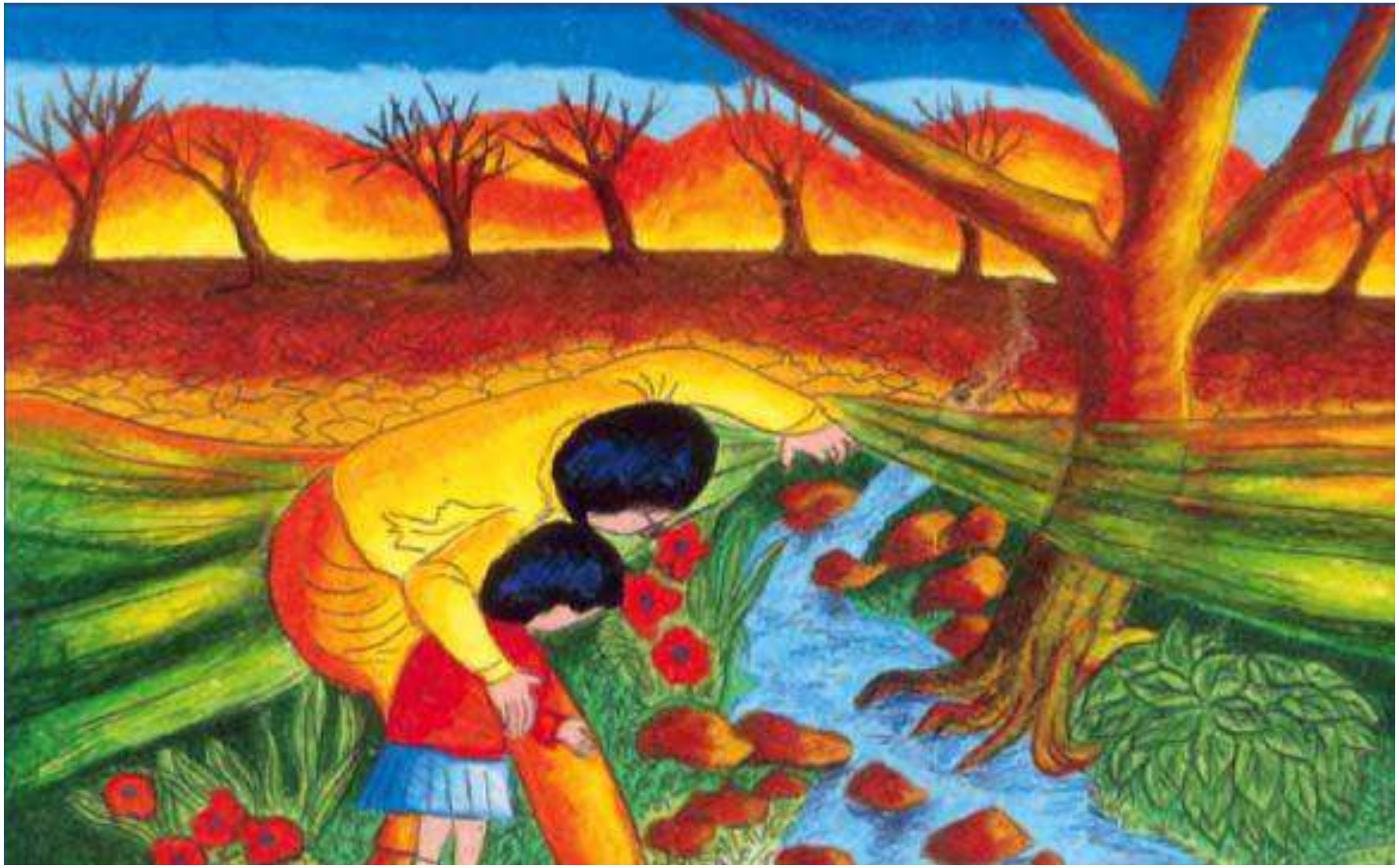
Possible ways forward



Possible ways forward

GRIPP objective

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

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Karen Villholth

k.villholth@cigar.org

http://gripp.iwmi.org/

https://www.groundwaterstatement.org/

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