British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Gateway to the Earth

Urban Groundwater & Groundwater Quality in Africa

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Kabwe town water supply, Zambia

Africa, Groundwater and the Sustainable Development Goals
25 October 2017, Geol. Soc., London

Critical role of groundwater in an urban context - working towards the SDGs

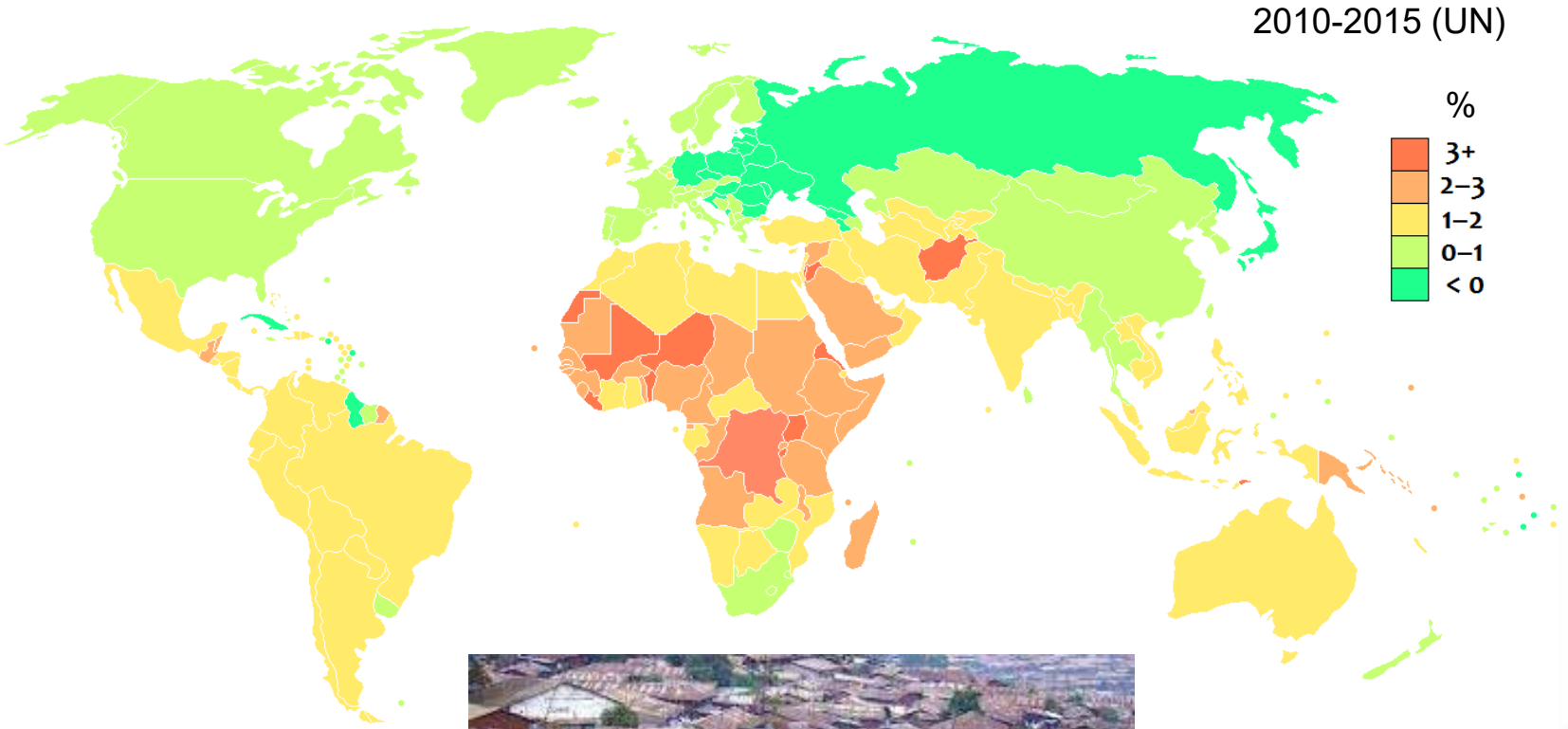
- Groundwater has much to offer in an urban context in Africa
- Groundwater development has a key role in working towards SDGs
- It is a resource we *cannot* afford to overlook
- Interconnected goals

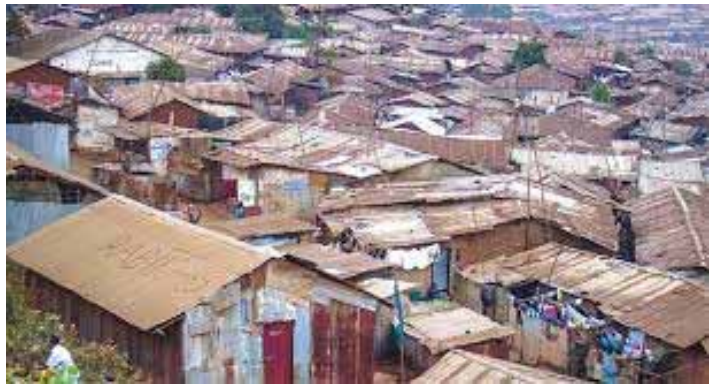
- Context: rising populations, urbanisation and changing behaviours

SUSTAINABLE DEVELOPMENT GOALS

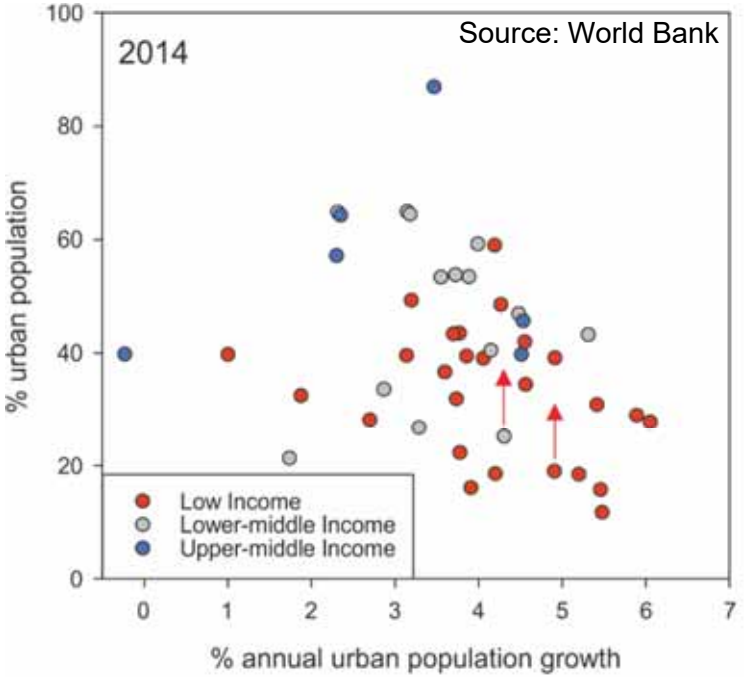
A growing population

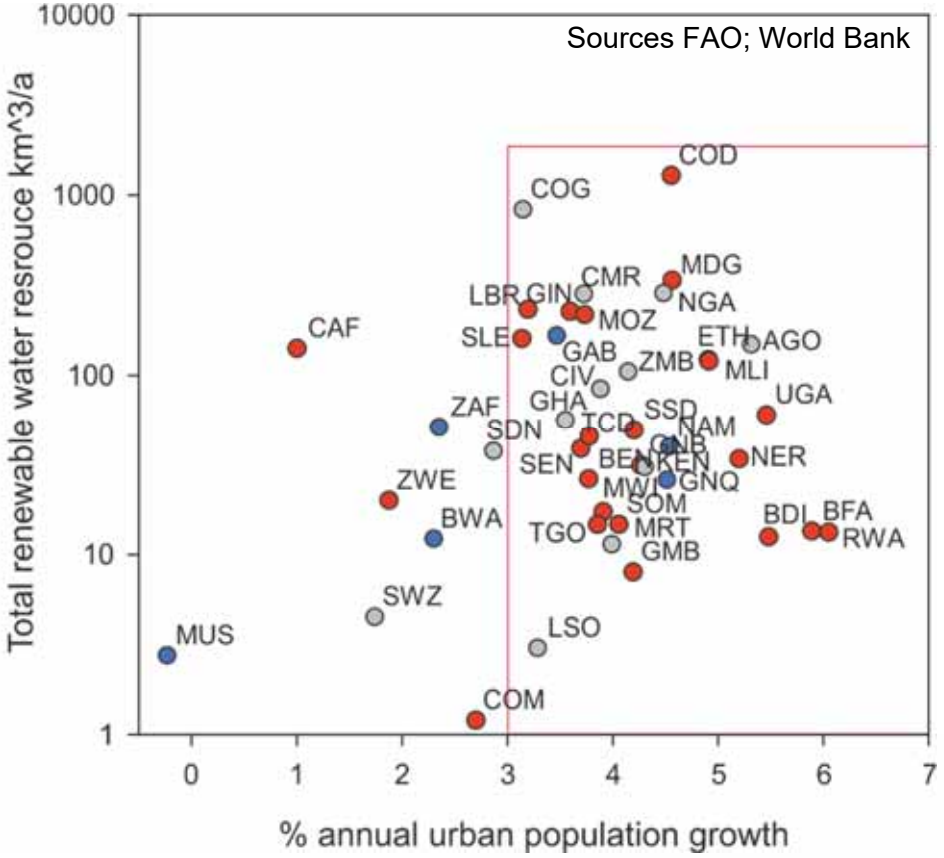
- Africa has some of the highest population growth globally
- By 2035 50% living in urban settlements (2.5 Billion – UN)



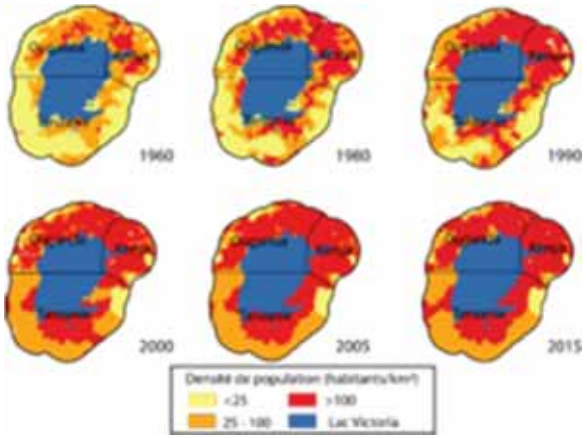


A growing urban population in SSA – with large renewable resources



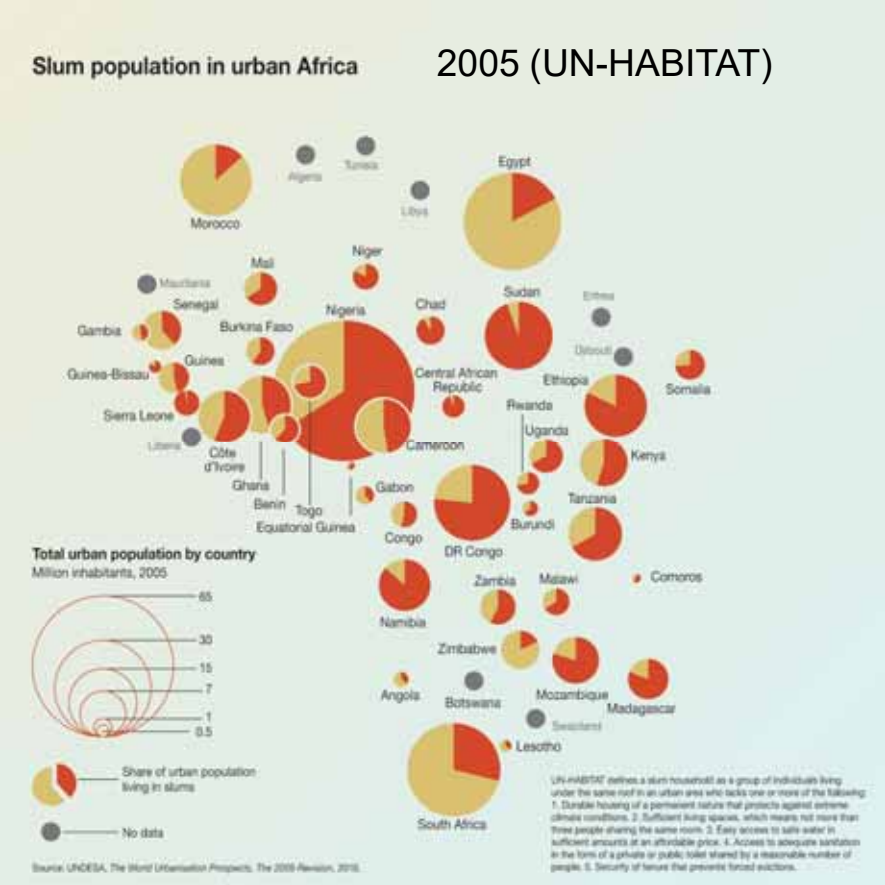


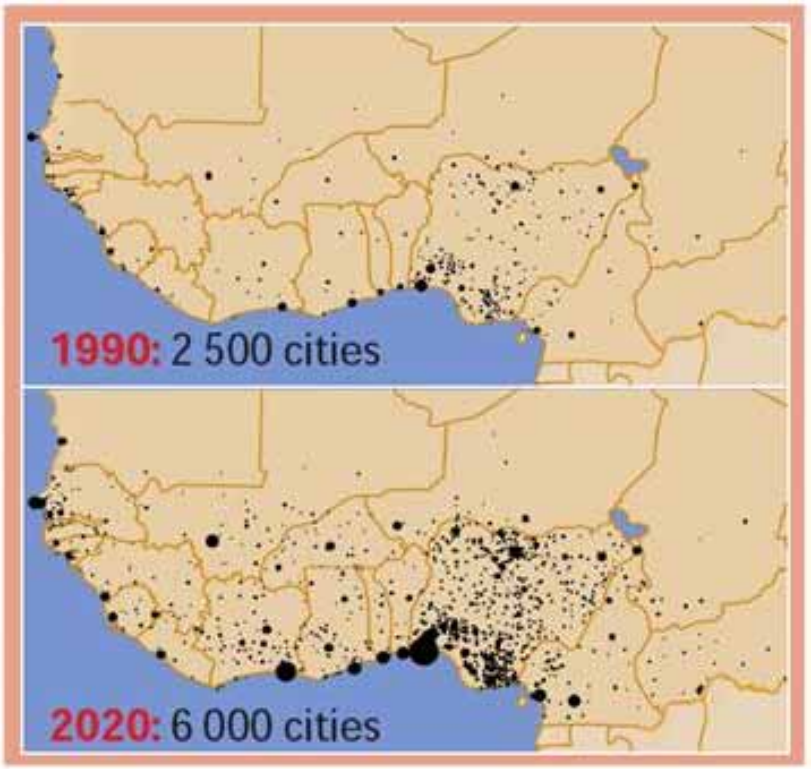
Lake Victoria (UNEP)



- Rising demand for urban water supplies
- Large renewable resources

A growing low income urban population

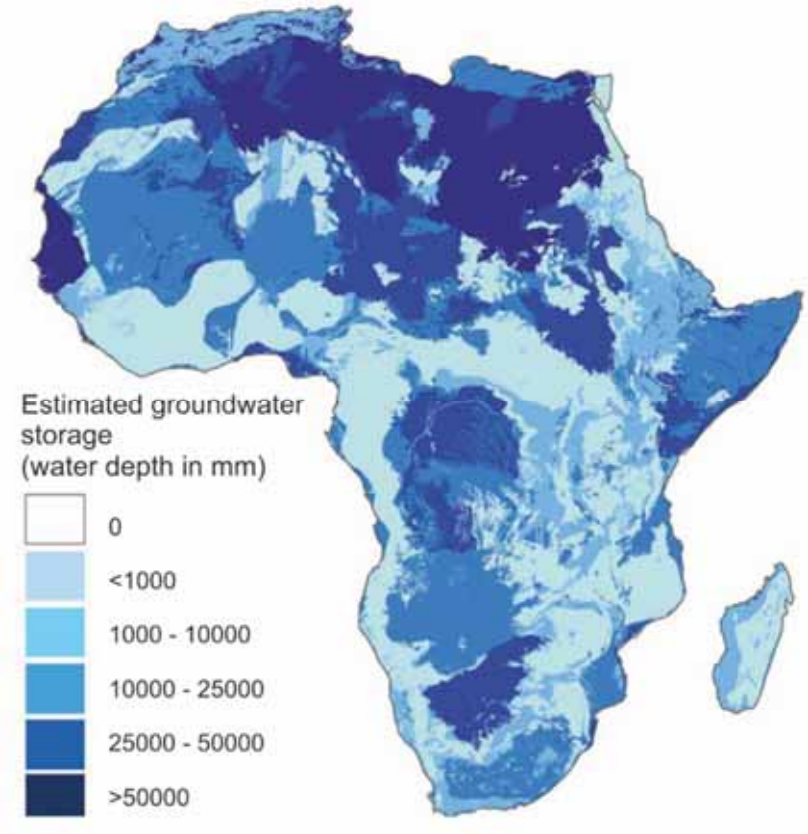


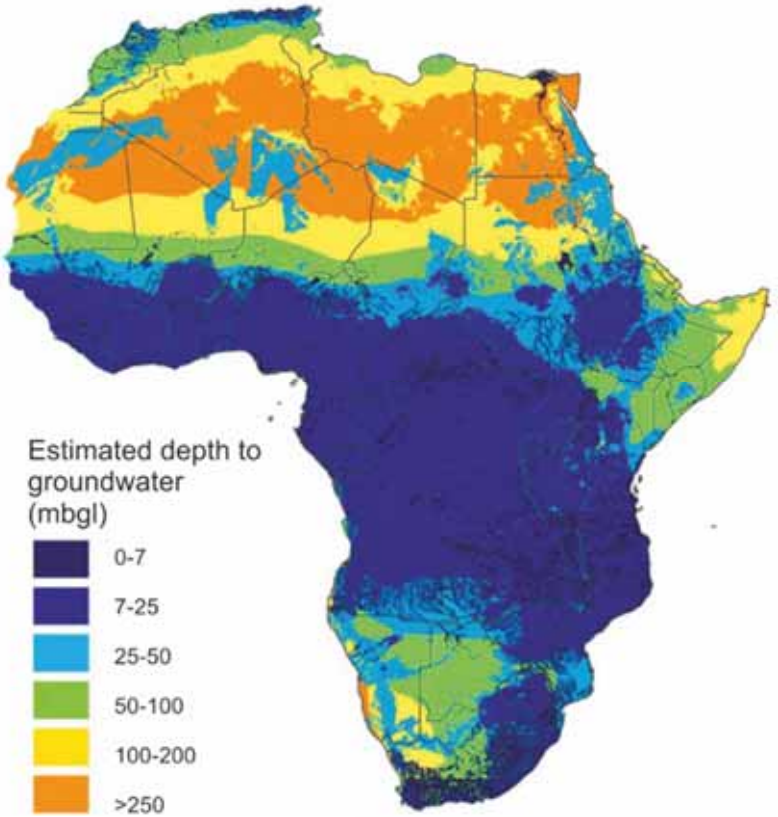


(Source: OECD, 1997)

- Urban growth across Africa – very high rates in parts of E & W Africa
- Urban low income population growth is very high
- Growth focussed in towns and smaller centres

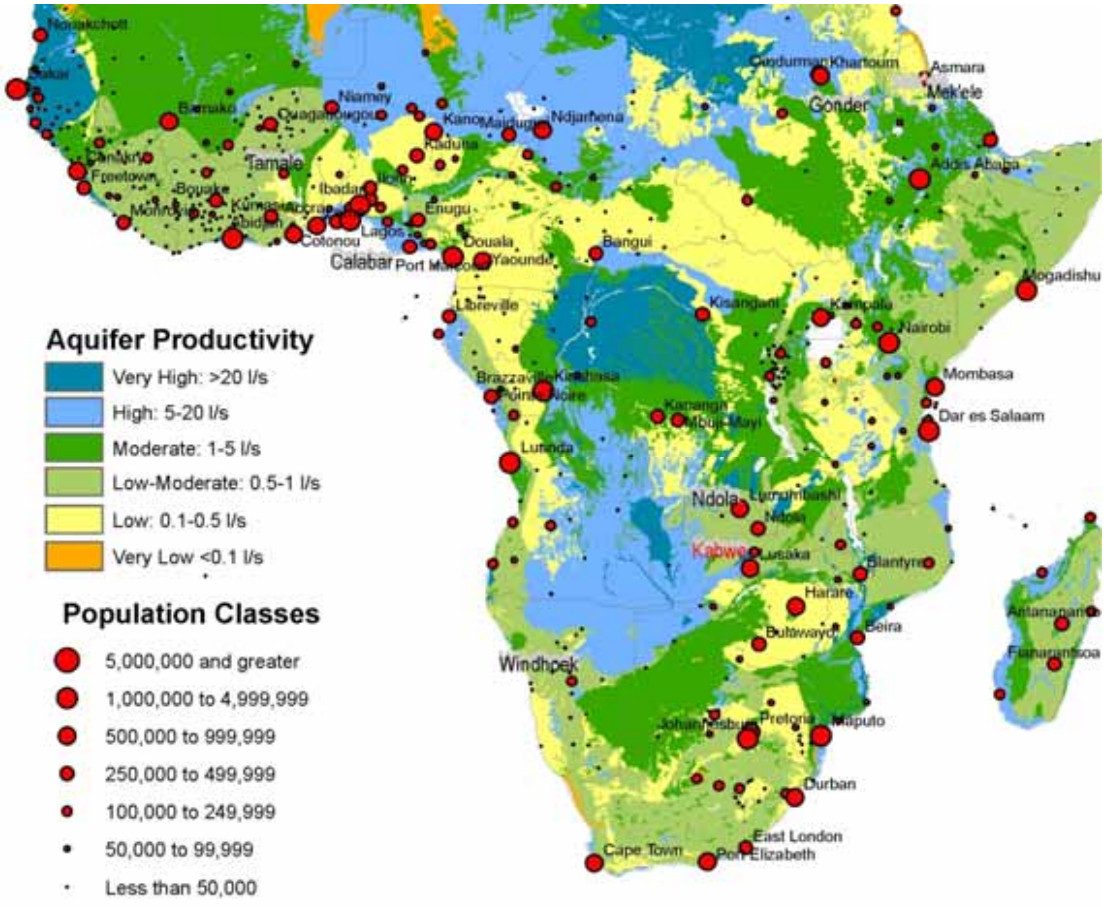
Groundwater: a huge freshwater resource





MacDonald et al. 2012. *ERL*

With real potential for future development



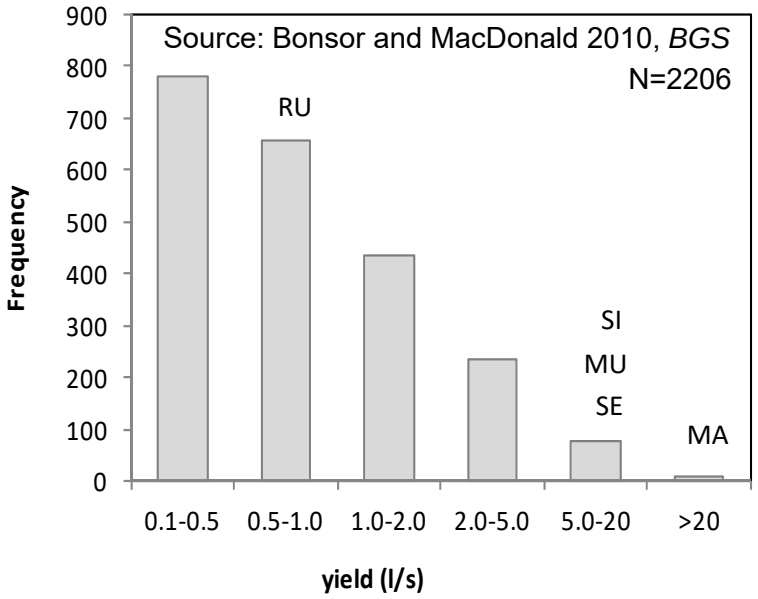
Adelana and MacDonald 2008, *CRC*

Lapworth et al. 2017, *BGS;* MacDonald et al. 2012*, ERL*

- Many urban centres located on moderate-high productivity aquifers
- National groundwater use is typically between 10-50% (UNEP & UNESCO)

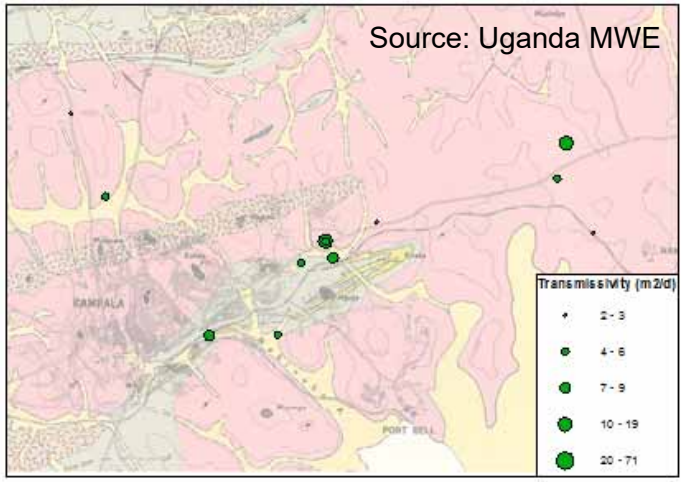
Large abstraction possible in some basement settings

Yields from basement aquifers in Africa



Town supply upgrade, Tanzania

Kampala – licenced large abstraction
Transmissivity 2-70 m2/d
*72h pump tests

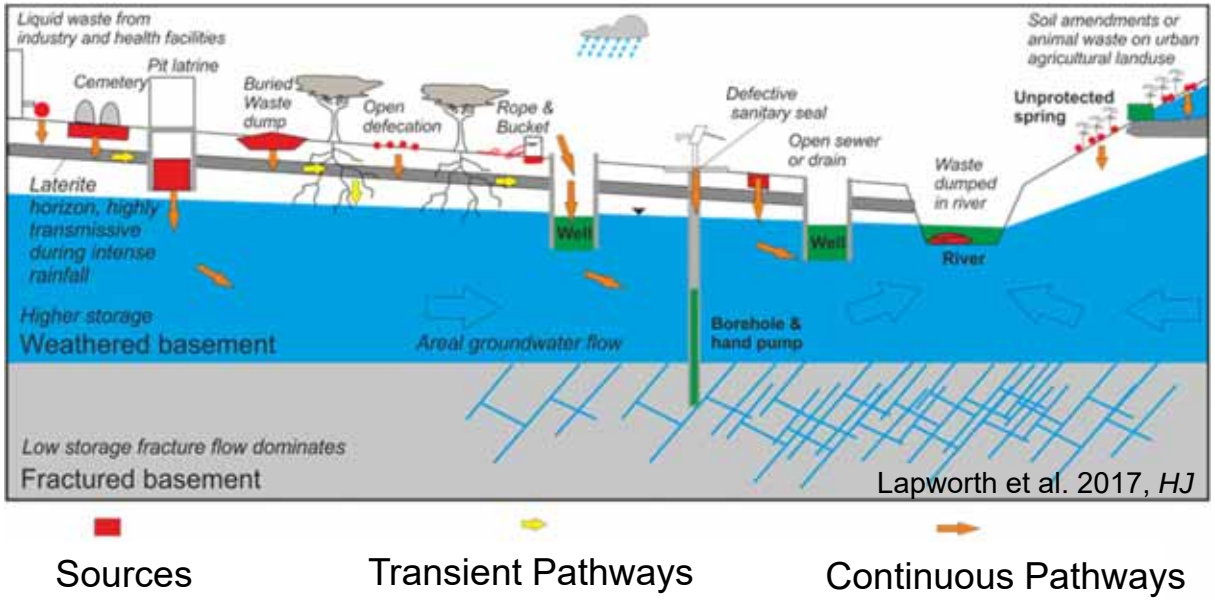


Large spring discharge, Kampala

Key water quality challenges

- Feacal waste management – contamination of shallow groundwater system
- Geogenic contaminants (As and F)
- Hydrocarbons and organic contaminants (e.g. plasticisers and anti-microb.)
- Legacy contaminants from industry
- Limited treatment even for municipal sources (surface and groundwater)

Sources and pathways for contaminant transport in basement settings

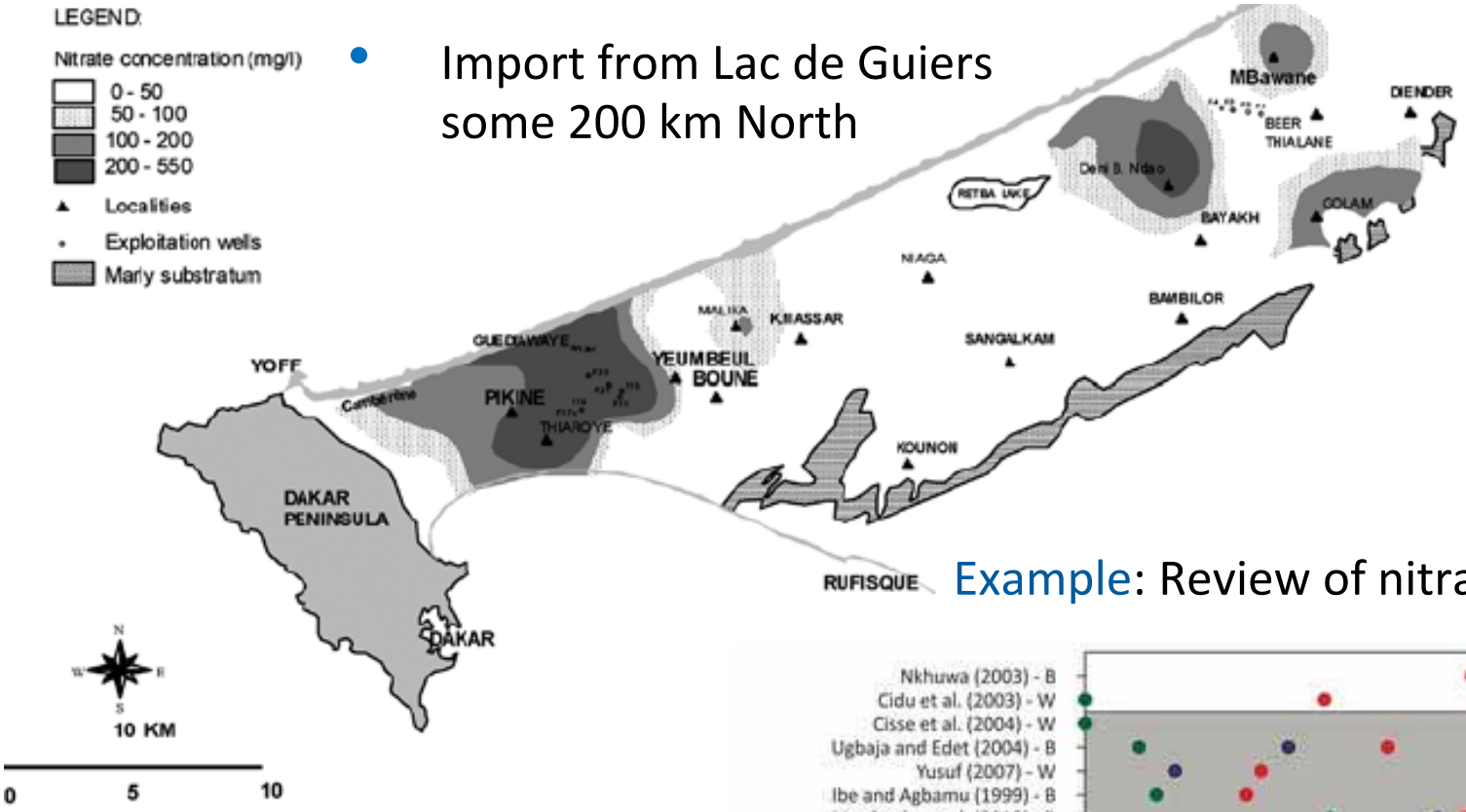


Sources Transient Pathways Continuous Pathways

- Deeper and better protected sources are currently under-utilised

Urban aquifer contamination

Example: Nitrate and faecal coliforms in the Thiaroye aquifer, Dakar, Senegal

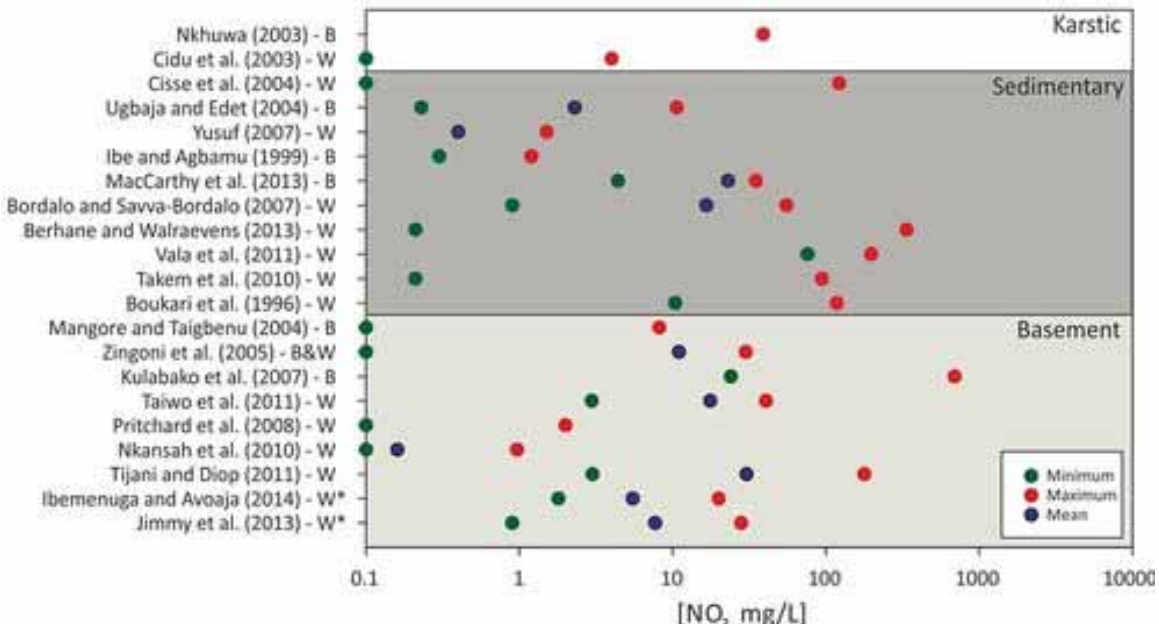


- Import from Lac de Guiers some 200 km North

Faye et al. 2004, *Env. Geol*.

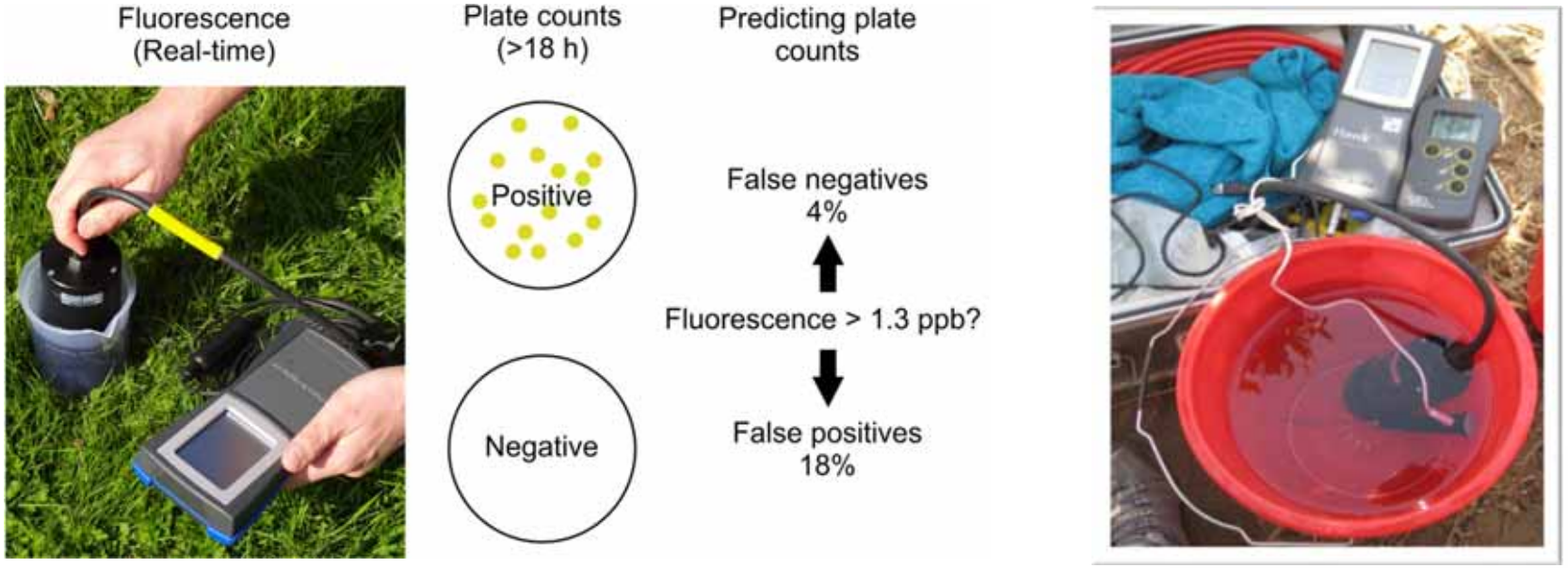
Example: Review of nitrate contamination

Lapworth et al. 2015, *BGS*



Improved techniques for water quality risk assessments (shameless plug!)

- *e.g*. Tryptophan Fluorescence: rapid screening tool for faecal contamination in drinking water supplies



Please take time to have a look at the new applications of this technique being presented in three posters by *James Sorensen*, *Jade Ward* and *Saskia Nowicki*

Water supply & health challenges

- Access to water in low income areas is wholly inadequate
- Piped or kiosk water is not affordable – alternative higher risk sources are used
- Higher risk from faecal contamination during flooding/shallow groundwater conditions
- Augmented self-supply is common for both low and high income groups
- 'Go smaller' options are meeting demands of rapid urban growth

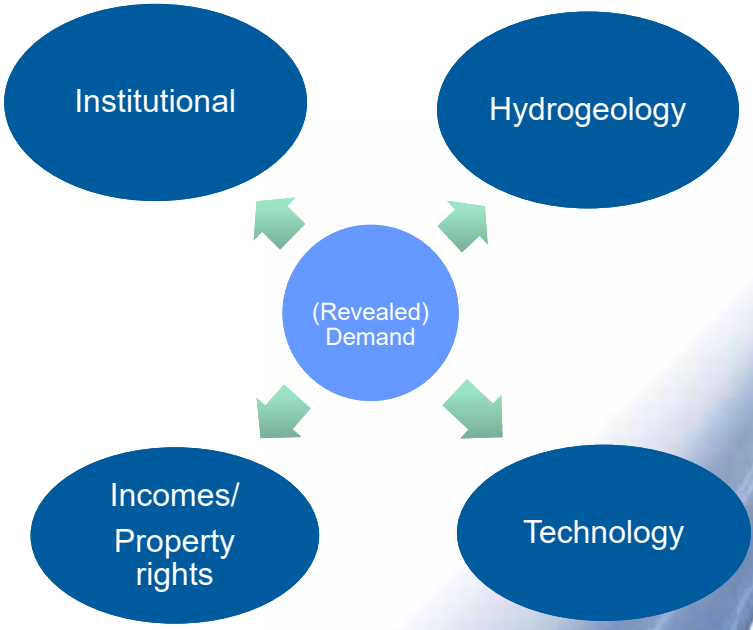
Example: Expansion of private boreholes in Lagos, Nigeria

51% of households owned their own borehole

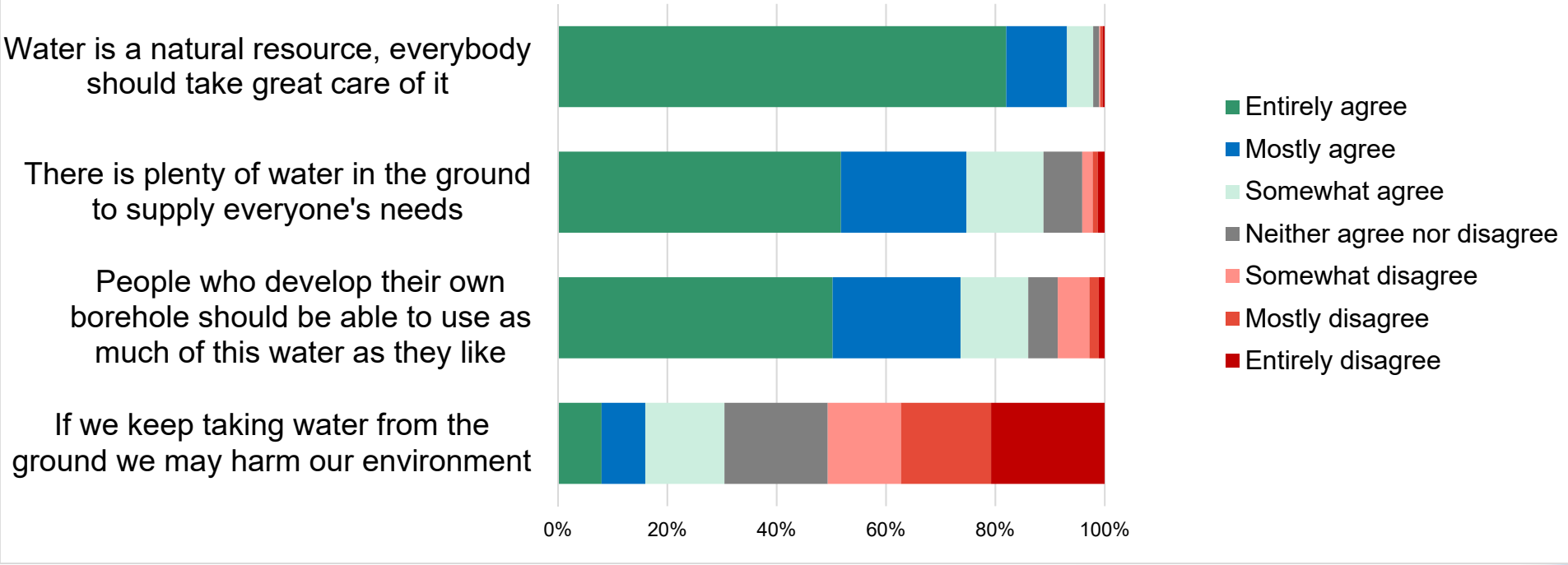
36% of households shared a borehole with other families

33% of households access public water supply as their primary source

Source: Healy et al. 2017, IAH AGM, Croatia



Example continued: Quantity of water available, household survey, Lagos



Source: Healy et al. 2017, IAH AGM, Croatia

- This reality is a real challenge to top-down governance models
- Will this be a more prevalent urban governance model in the future?
- Risk of future inequality – *salutary lessons from examples in Asia*

Summary

Groundwater…..

- Resources are currently under-utilised across SSA
- Development is a major opportunity to improve access to more resilient urban water supply – *particularly for growing towns*
- Fills a rapidly growing *water-supply gap* for urban dwellers
- Quality and quantity constraints need to be considered
- Monitoring is urgently needed as ‘anarchic/liberal’ urban groundwater governance gathers pace in SSA