British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Gateway to the Earth

Urban Groundwater & Groundwater Quality in Africa

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British Geological Survey, Maclean Building, Wallingford, UK

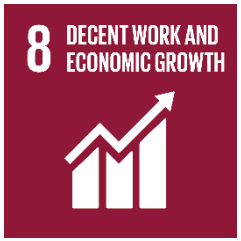
Kabwe town water supply, Zambia

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

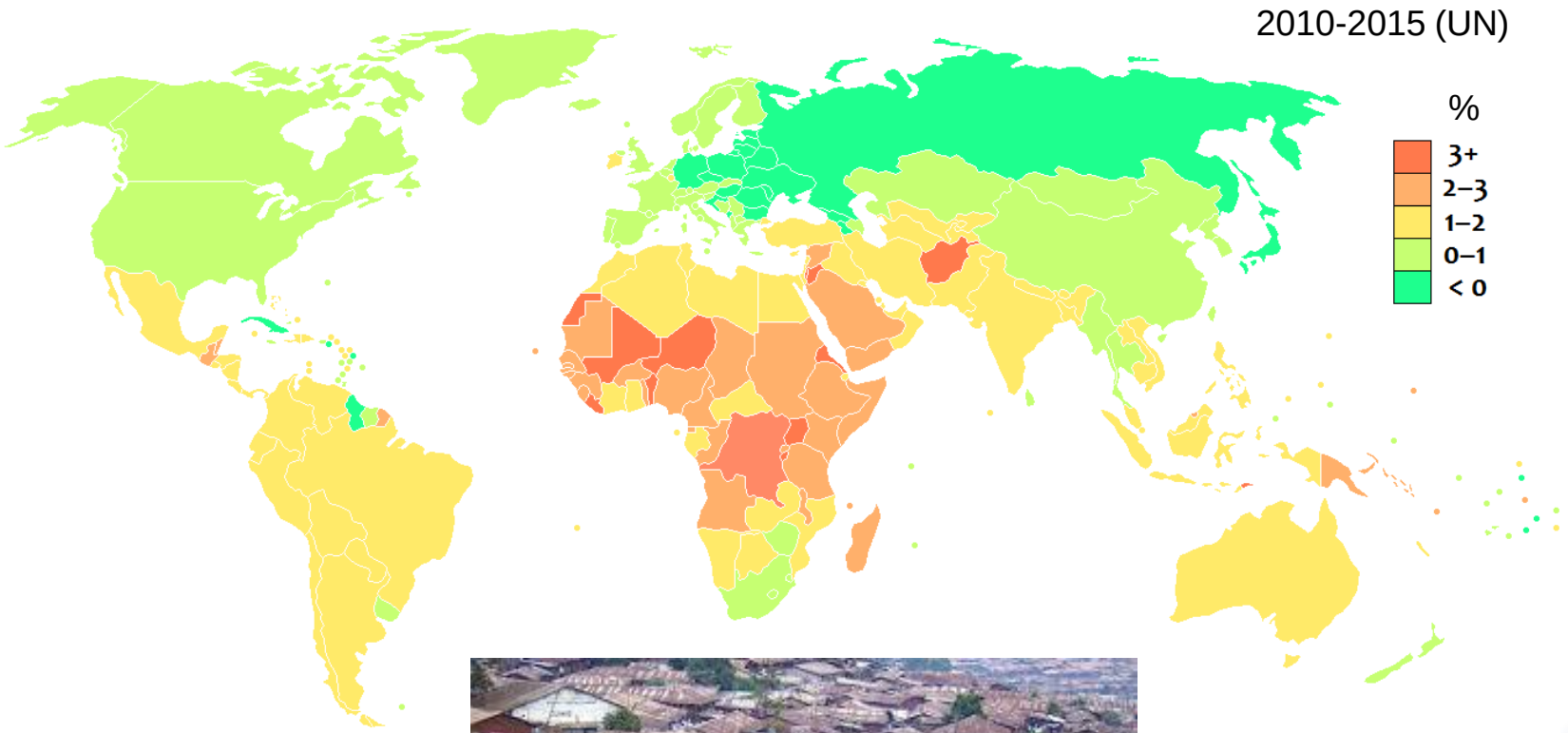
- Groundwater has much to offer in an urban context in Africa
- Groundwater development has a key role in working towards SDGs
- It is a resource we *cannot* afford to overlook
- Interconnected goals

- Context: rising populations, urbanisation and changing behaviours

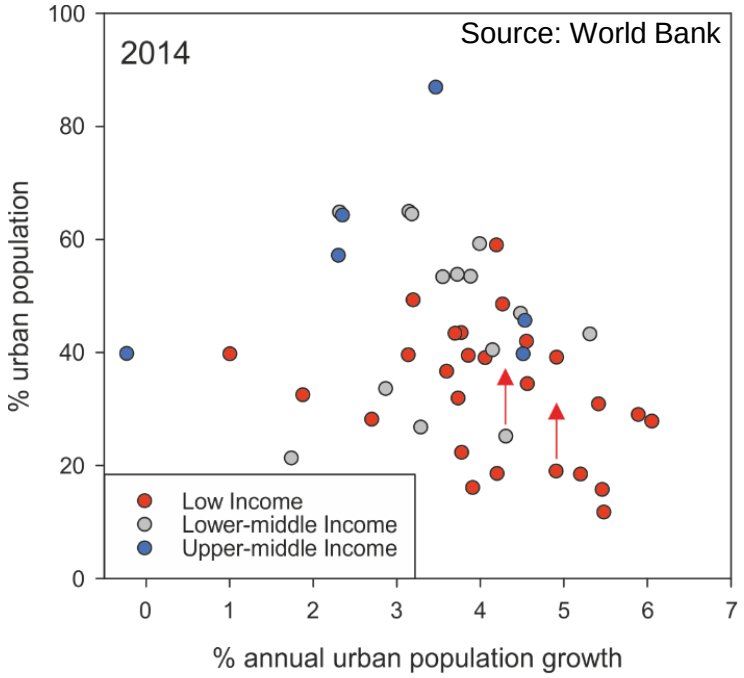


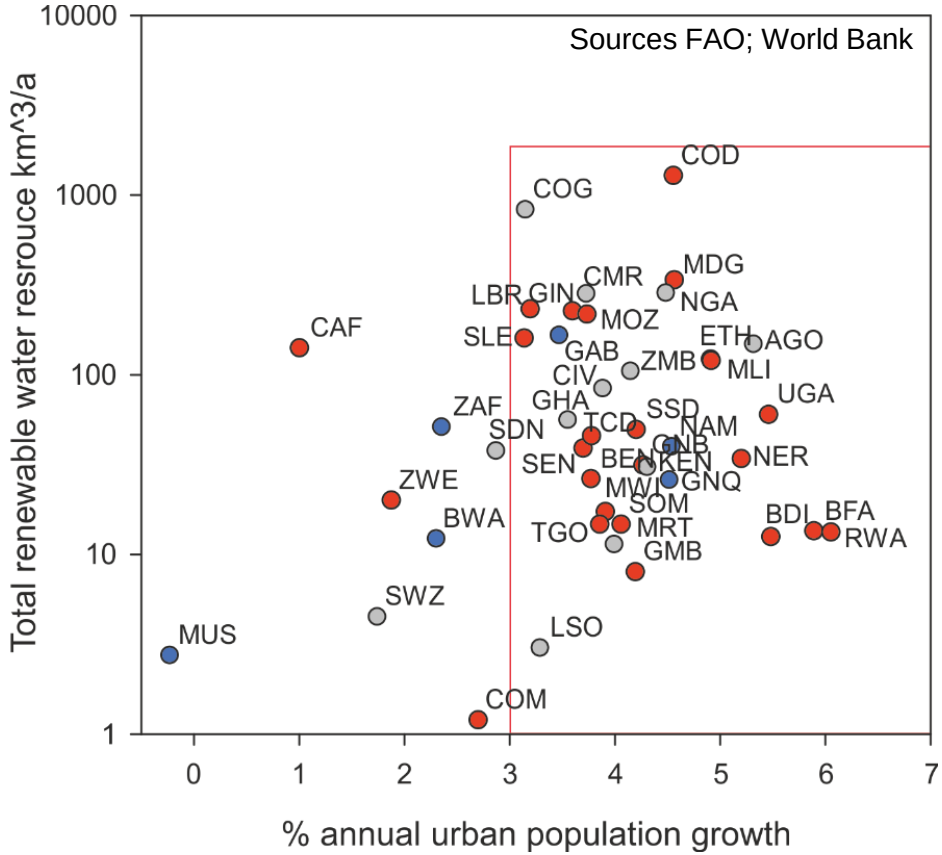
A growing population

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

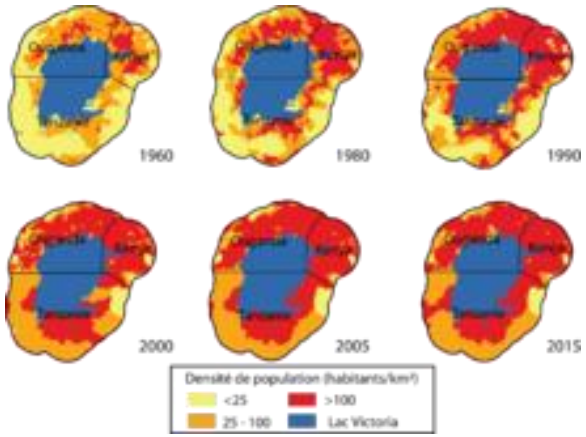


A growing urban population in SSA – with large renewable resources



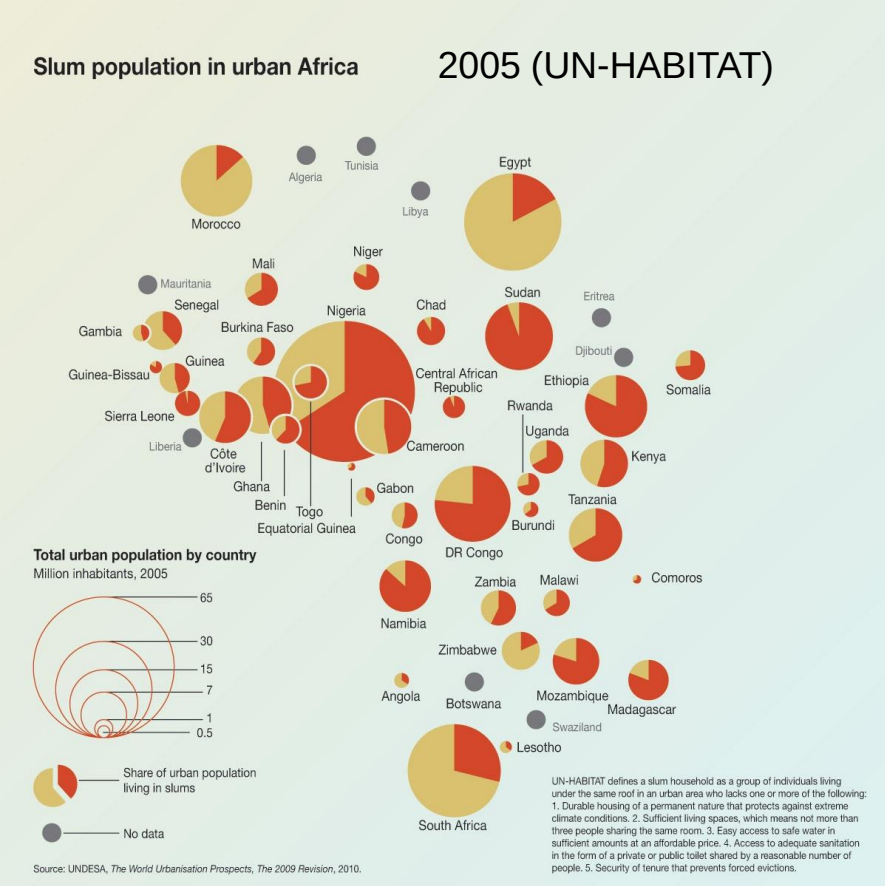


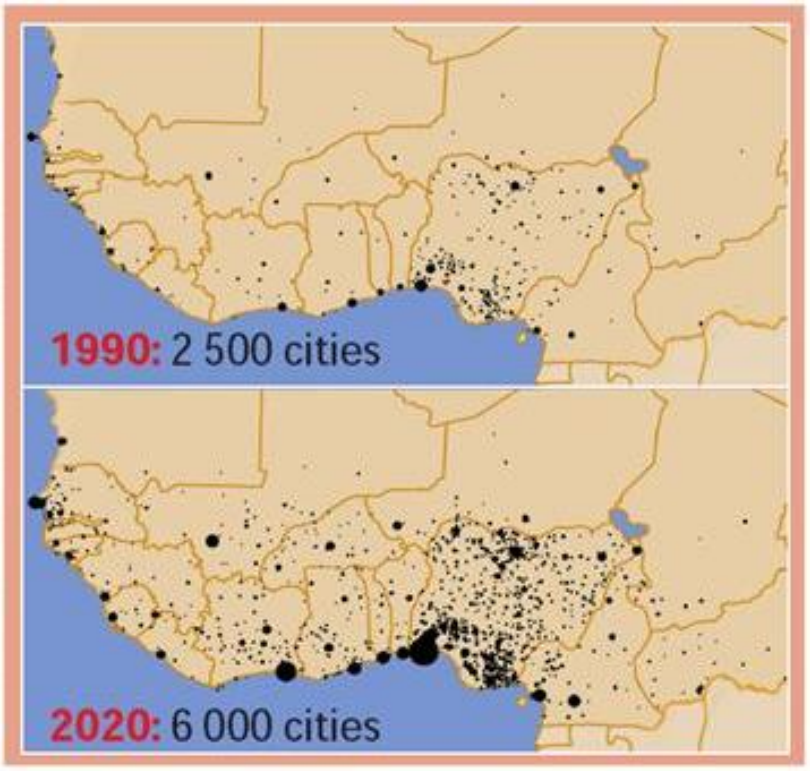
Lake Victoria (UNEP)



- Rising demand for urban water supplies
- Large renewable resources

A growing low income urban population

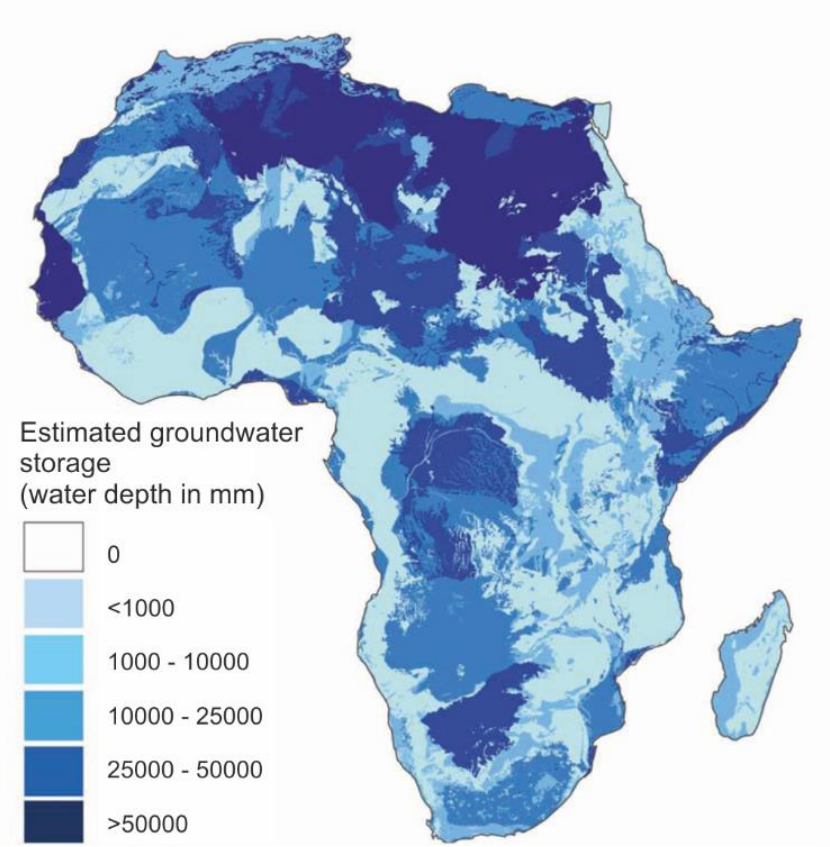


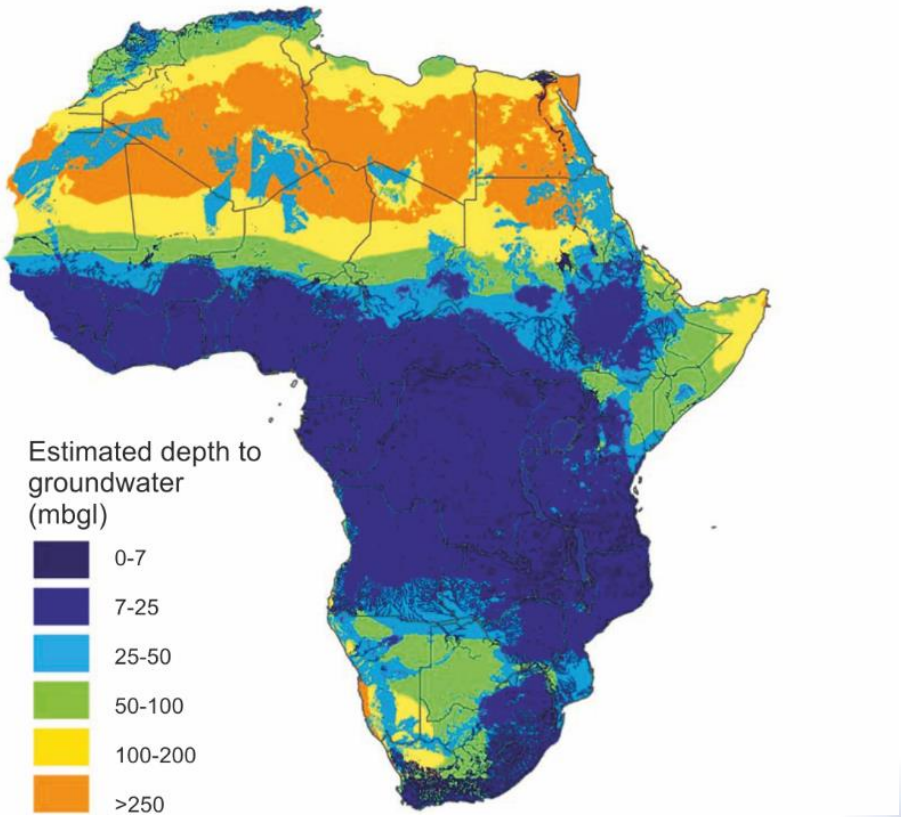


(Source: OECD, 1997)

- 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

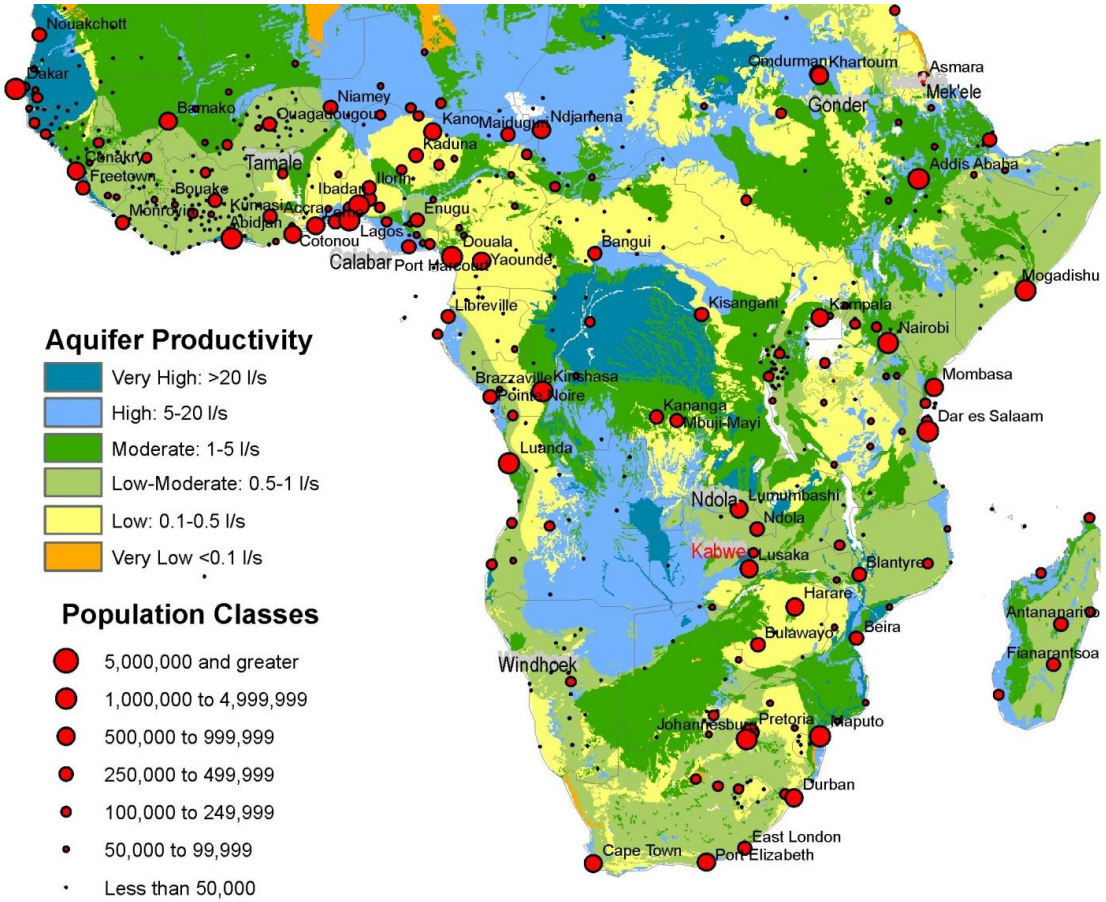
Groundwater: a huge freshwater resource





MacDonald et al. 2012. *ERL*

With real potential for future development



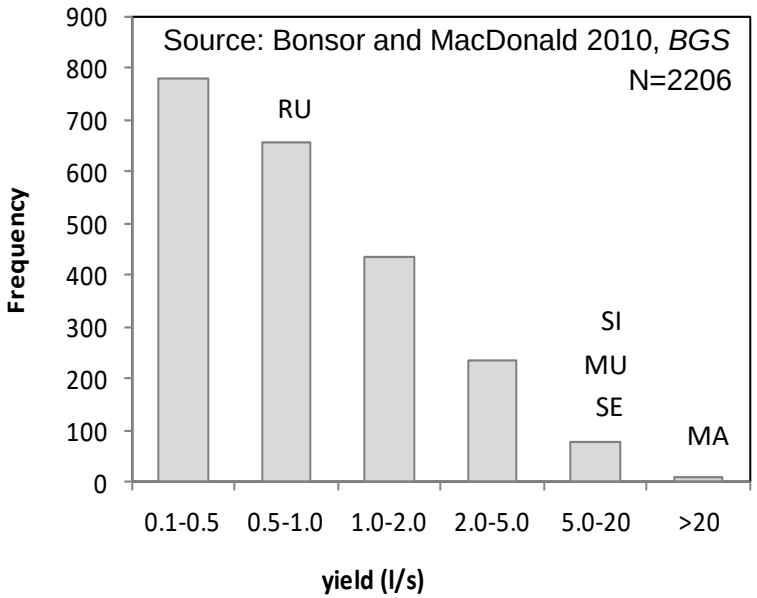
Lapworth et al. 2017, *BGS;* MacDonald et al. 2012, *ERL*

Adelana and MacDonald 2008, *CRC*

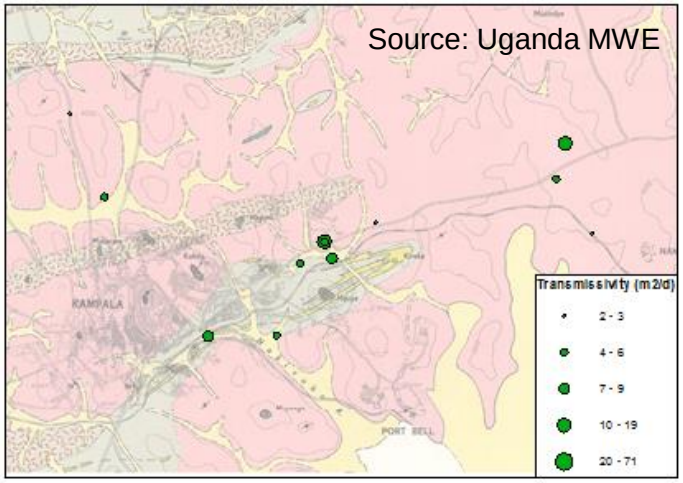
- Many urban centres located on moderate-high productivity aquifers
- National groundwater use is typically between 10-50% (UNEP & UNESCO)

Large abstraction possible in some basement settings

Yields from basement aquifers in Africa



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



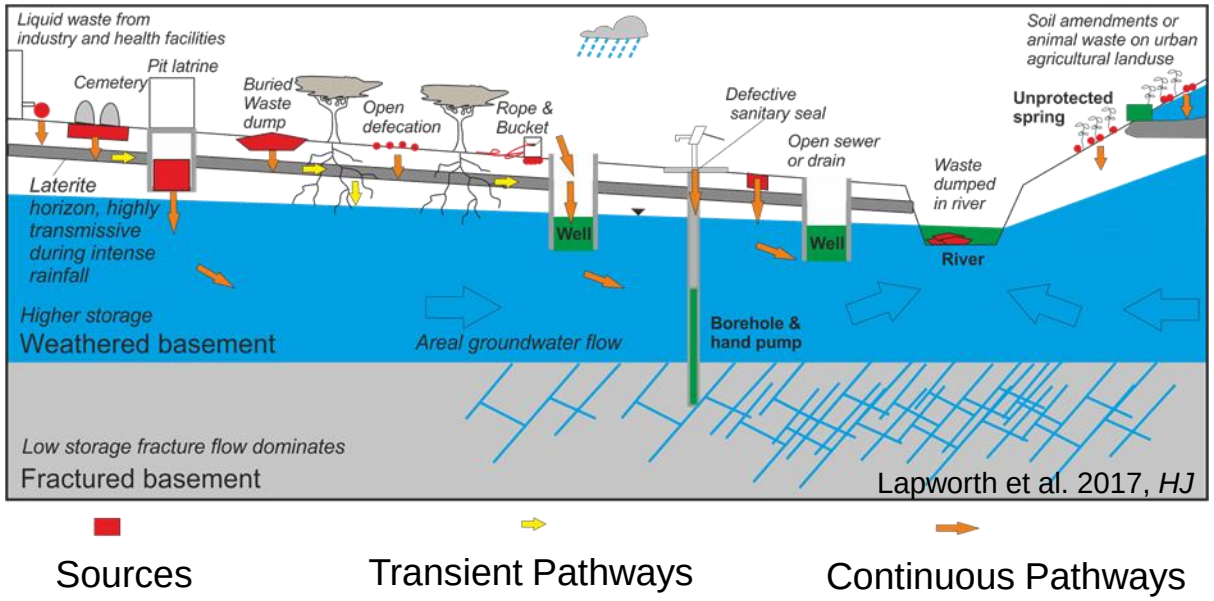
Town supply upgrade, Tanzania

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)

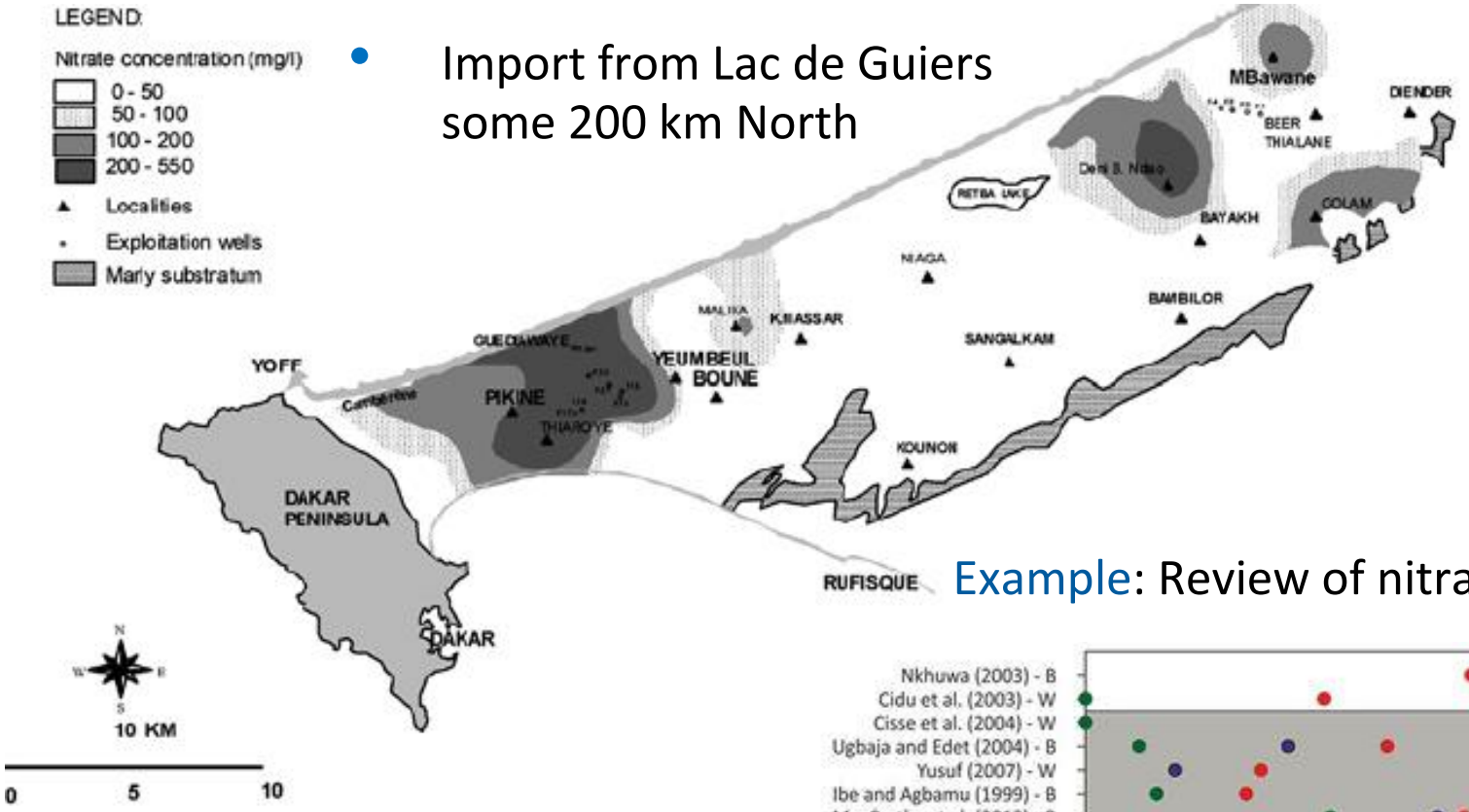
Sources and pathways for contaminant transport in basement settings



- Deeper and better protected sources are currently under-utilised

Urban aquifer contamination

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

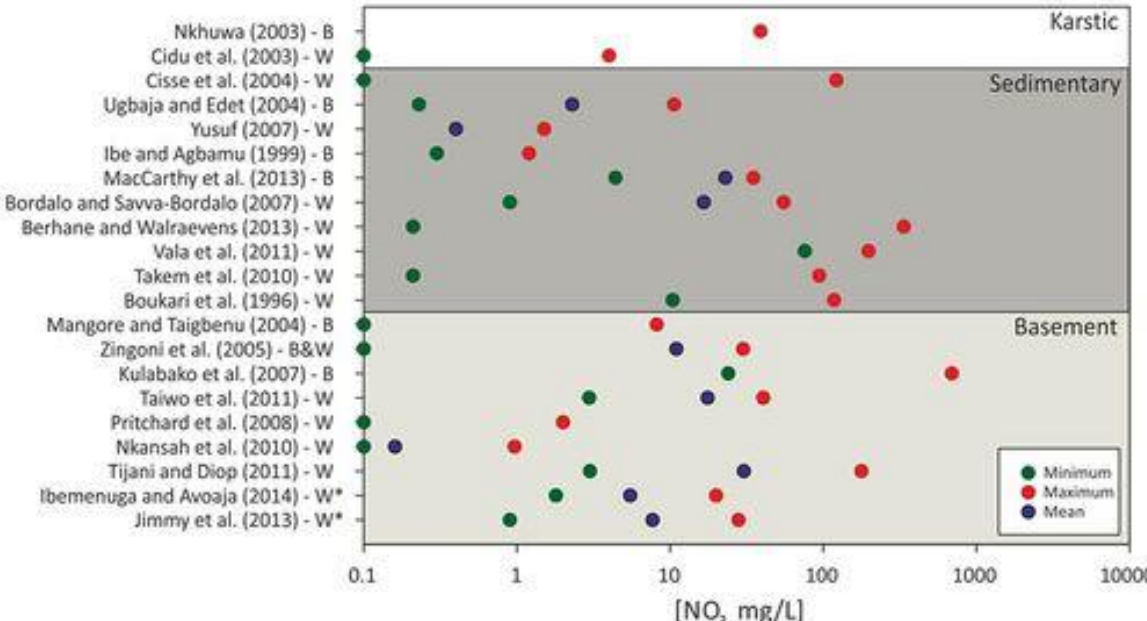


- Import from Lac de Guiers some 200 km North

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

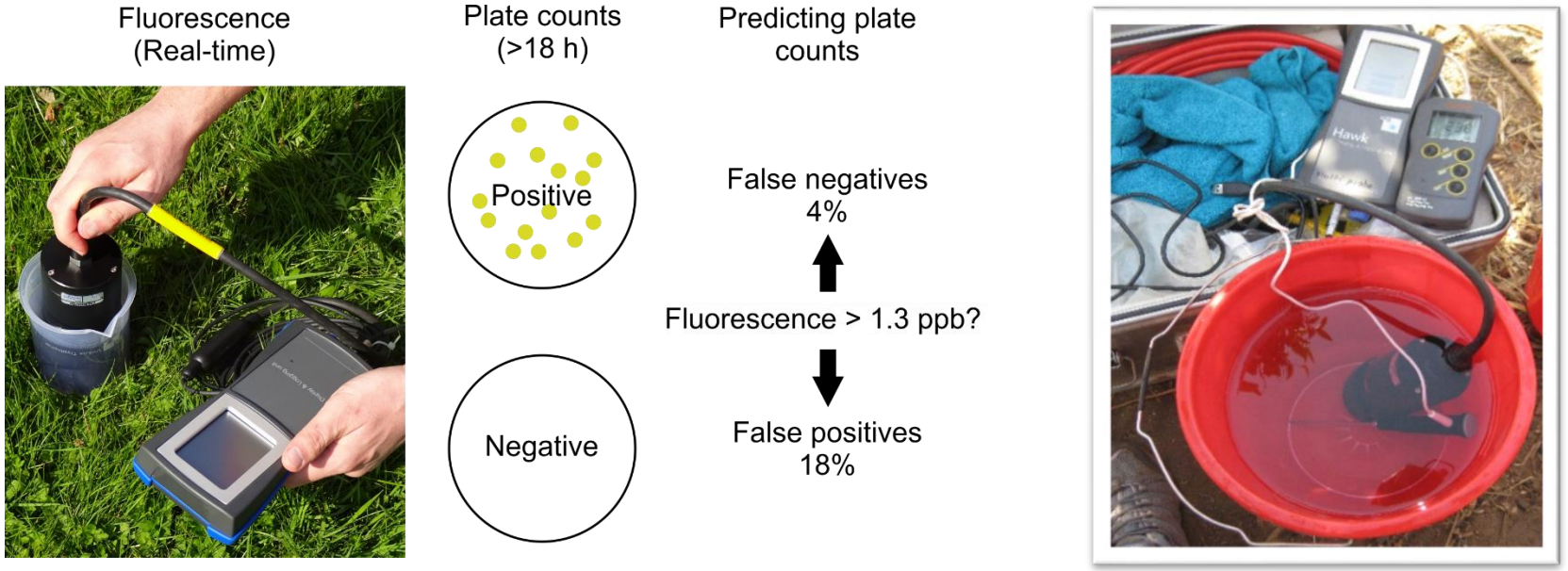
Example: Review of nitrate contamination

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

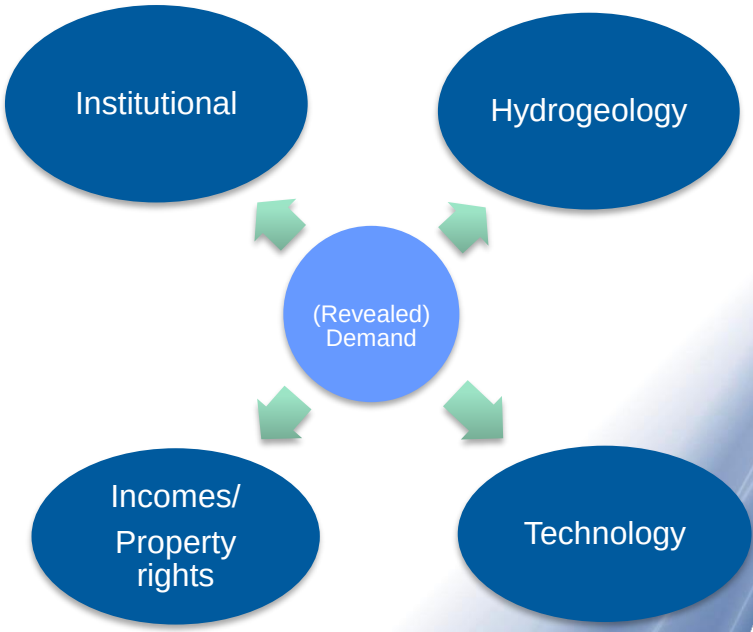
Example: Expansion of private boreholes in Lagos, Nigeria

51% of households owned their own borehole

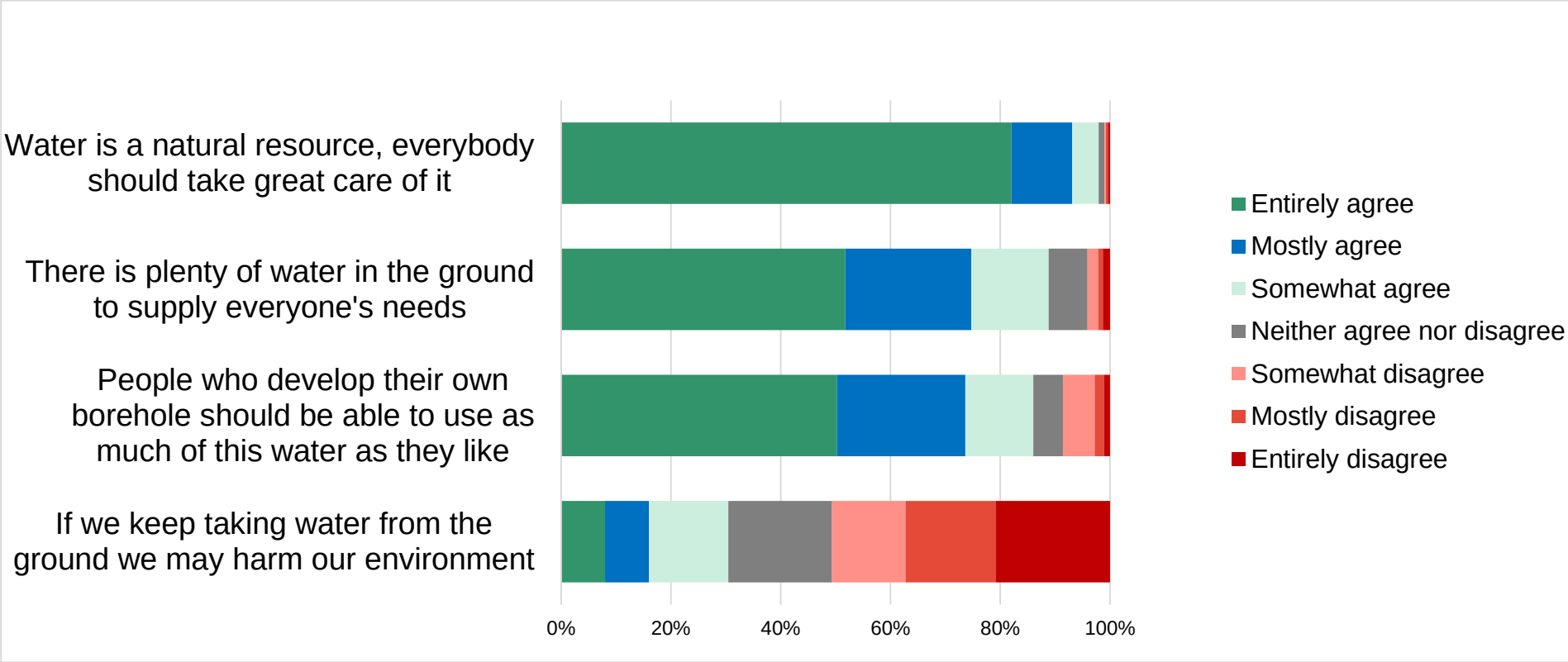
36% of households shared a borehole with other families

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