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Extreme heterogeneity in the volcano-sedimentary aquifer system of Kisumu: challenges for groundwater development and management

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JAPHET RUGENDO KANOTI

Co-Authors: Daniel Olago, Norbert Opiyo, Christopher Nyamai, Richard Taylor, Simeon Dulo, Richard Ayah

Presentation outline

- Introduction
- Why groundwater?
- Methodological approach
- Results
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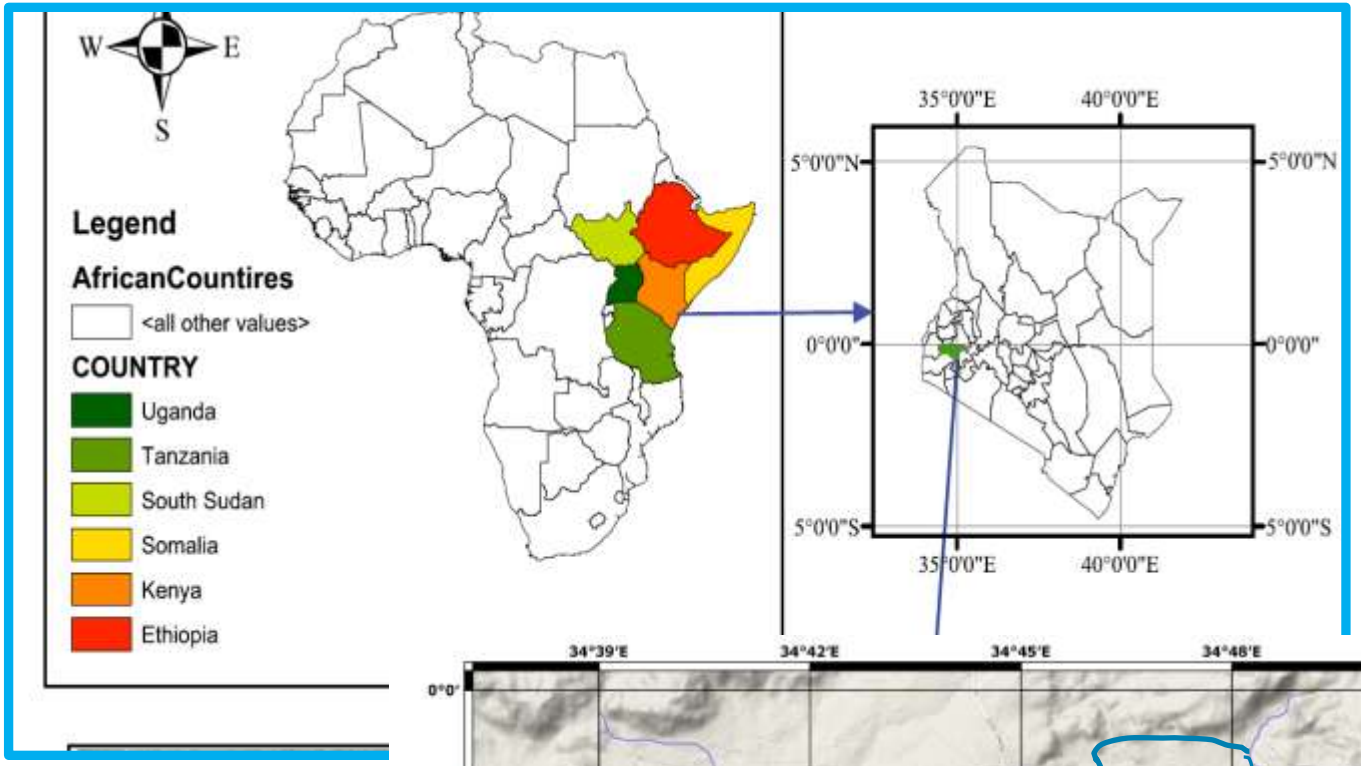
- Acknowledgement

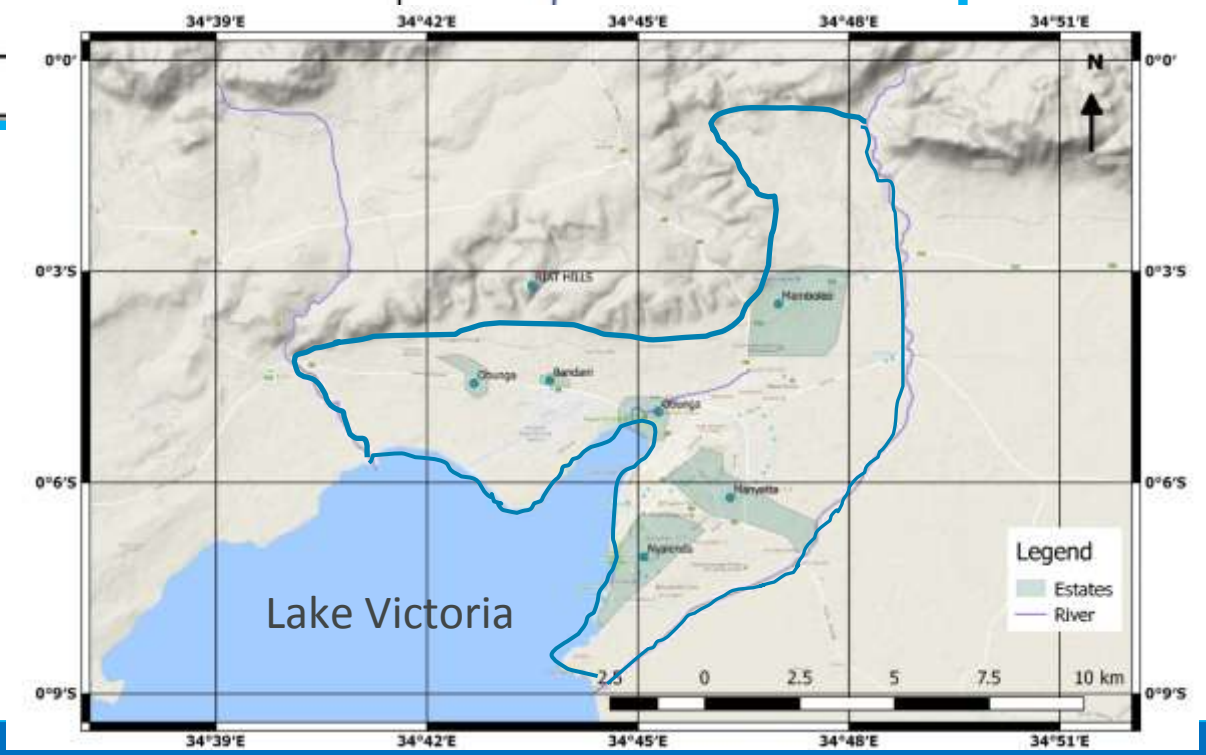
Introduction

- Groundwater constitutes a source of safe water in both rural and urban settings in Kenya.
- Both National and County governments are striving to realize United Nations' Sustainable Development Goal 6 on access to safe water for all by the year 2030; further, the Constitution of Kenya Section 43 on economic and social rights guarantees access to safe water in adequate quantities.
- Research under *AfriWatSan* (afriwatsan.org), supported by The Royal Society (UK) and DFID, examines the challenges of meeting these obligations through the use of groundwater from a heterogeneous volcano-sedimentary aquifer in Kisumu, Kenya



Kisumu Facts:

- Third largest town in Kenya
- Population of >1 million
- Surface water sources: Lake Victoria and R. Kajulu
- Groundwater: springs, shallow wells and borehole
- Other water sources: swamps, rivers, rainwater



Why groundwater?

- Groundwater is the preferred source of water in the peri-urban (off-grid) areas in Kisumu, the third largest City in Kenya located on the eastern shores of Lake Victoria.

- Groundwater is the preferred source of safe drinking water as it is better protected from pollution, less variable in the availability supply due to aquifer storage, and enables scaled development close to user demand that reduces the magnitude of capital costs.

How to get groundwater and monitoring

Methodological approach

- Six piezometers/observation wells were drilled in Kisumu and installed with data loggers (Rugged Troll 100) recording hourly groundwater levels.
- Wells were logged during drilling at one-metre interval to assess lithological contacts and variations.
- Pumping tests and recovery tests were conducted after the completion of drilling to characterize hydraulic parameters: specific capacity, transmissivity and well yields.
- Pumping tests were conducted to estimate the aquifer response, under controlled conditions, to the abstraction of water.

Results

- Hydraulic testing, geophysics and borehole lithological logs show that hydraulic characteristics of aquifers and aquitards in the study area are extremely heterogeneous
- Aquifer lithologies vary from purely volcanic to sedimentary rocks, and to alternating layers of volcanic and sedimentary rocks
- Well yields: range from 0.05 m^3/hour to 4 m^3/hour
- Specific capacities: range from 0.04 m^2/day to 3.2 m^2/day
- Aquifer transmissivities: range from 0.09 to 9.0 m^2/day

Discussion

- Extreme heterogeneity in hydrogeological properties poses a distinct challenge to the promotion of shallow groundwater as a safe source to achieve UN SDG 6 in either urban or rural settings
- Hydrogeological heterogeneity also challenges governance of the resource that necessarily requires coherent management at local scales by local communities.
- Hydrogeological heterogeneity also challenges the sustainability of investments in the development of groundwater supplies – particularly self-supply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