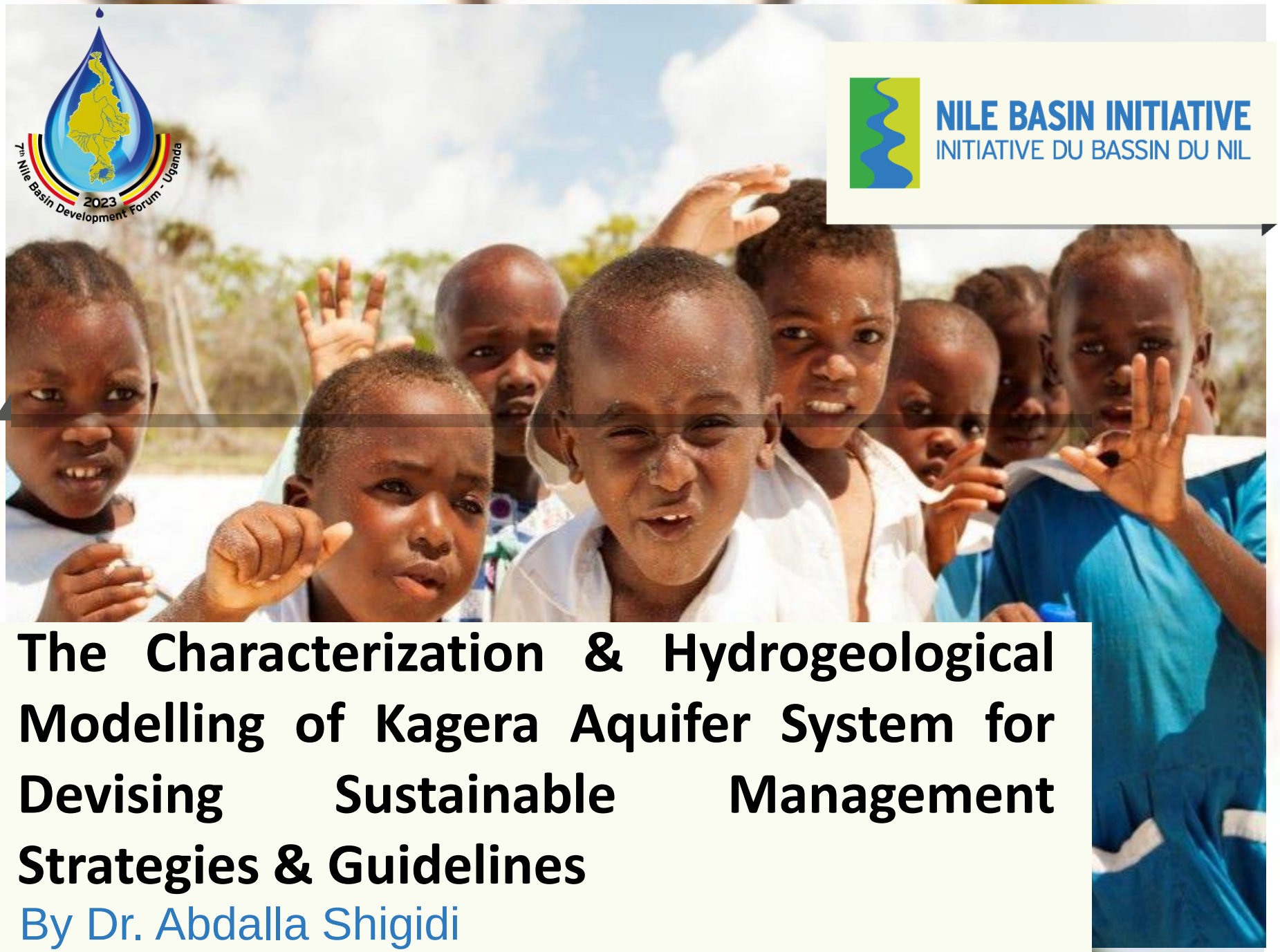


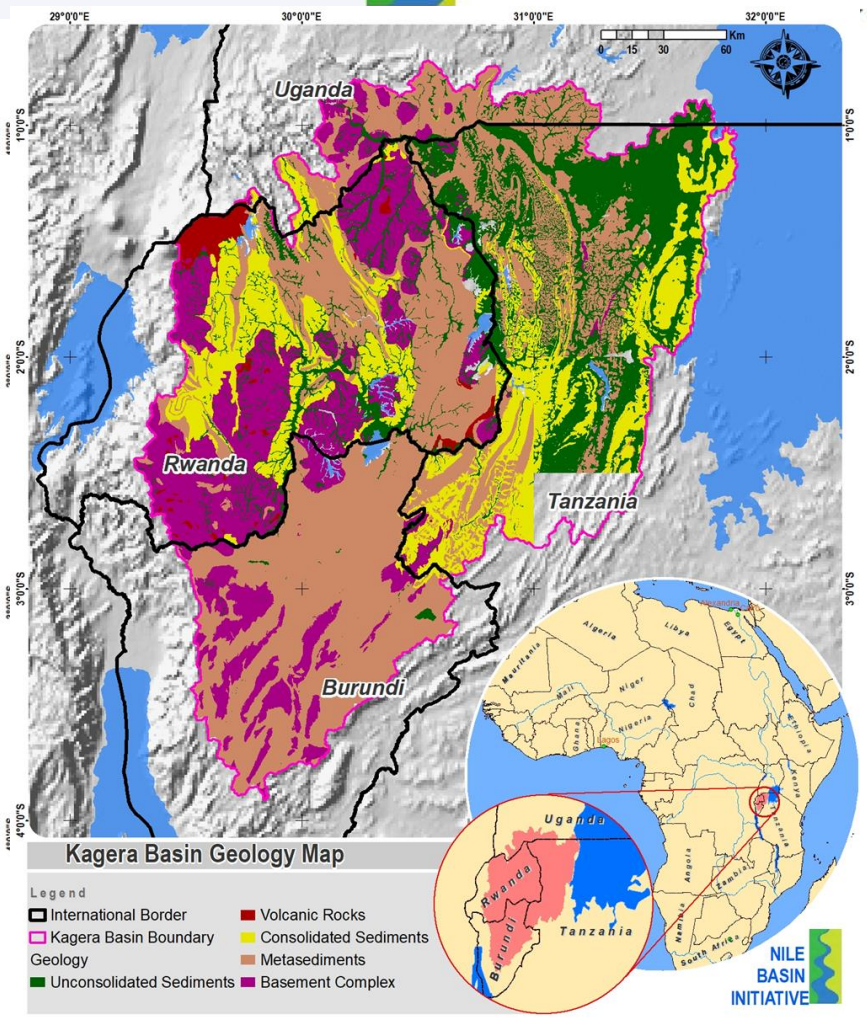
The Characterization & Hydrogeological Modelling of Kagera Aquifer System for Devising Sustainable Management Strategies & Guidelines

By Dr. Abdalla Shigidi

Kagera Basin

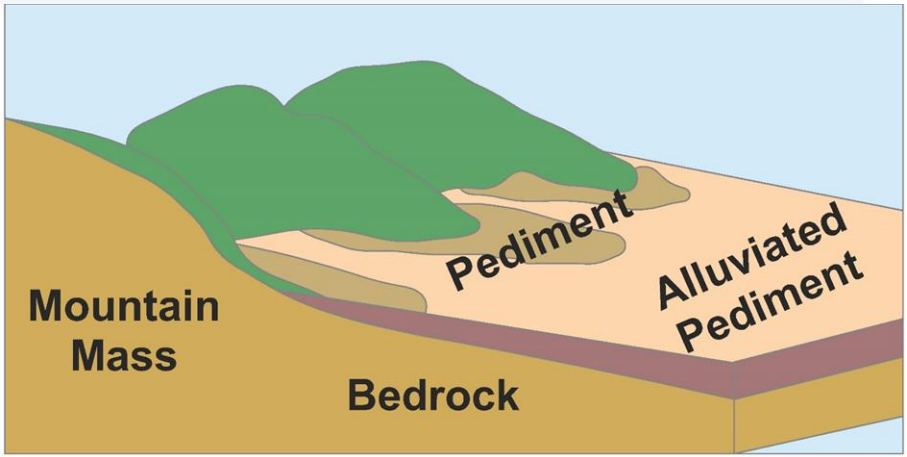
- The Kagera river basin forms the headwater of the river Nile, the river is the largest tributary of lake Victoria.
- The basin is shared by Burundi, Rwanda, Tanzania and Uganda.
- Kagera aquifer is an integral part of the water resources and environmental system in the area

Country	Catchment Area (Km2)	% Of Total Catchment Area
Burundi	13,060	22
Rwanda	20,550	34
Tanzania	20,210	34
Uganda	5,980	10
Basin	59,800	100



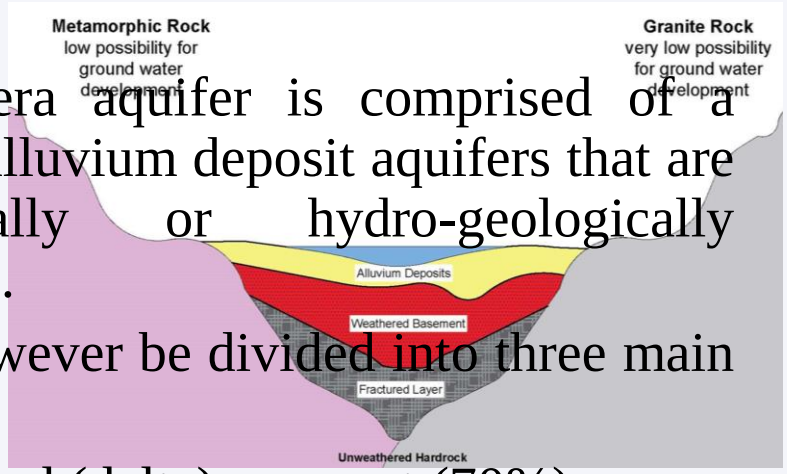
Kagera Aquifer Extent

- The Kagera aquifer is for the most part defined as the low areas of alluvium deposits around the Kagera River.
- Thickness varies from 5 m upstream in Burundi and increases to reach 50-80m downstream (based on drilled well depths). The alluvium layer, is underlain in either by a fractured basement complex / Metasedimentary rocks or by consolidated sedimentary formations.
- Groundwater occurs in Kagera aquifer in unconfined conditions and flow direction is follows the Kagera River flow direction
- Potential Sources of recharge include Flow from the Kagera River, Wetlands, Surface Runoff, Direct Precipitation, and flow from Fissures

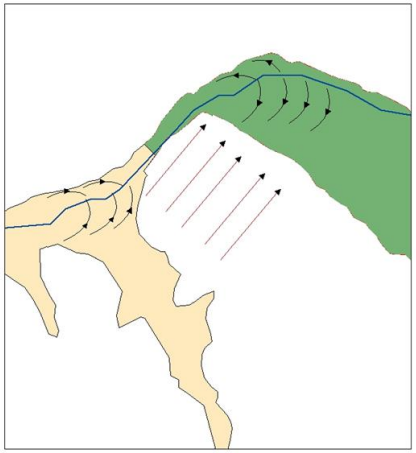


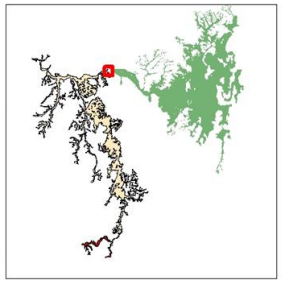
Country	Aquifer Area (sq Km)	Aquifer Area Distribution %	Population within Aquifer Area	Population within Aquifer Area Distribution %
Burundi	70	1	28,000	3
Rwanda	830	13	124,000	14
Uganda	1400	22	192,000	22
Tanzania	4000	63	529,000	61
Total	6300		873,000	

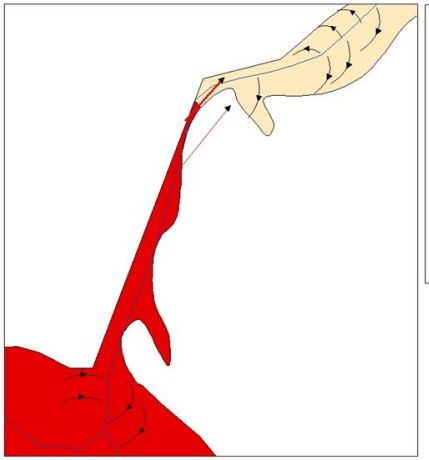
Groundwater Occurrence in the Kagera Basin

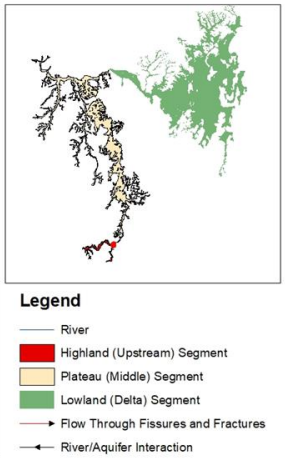


- The Kagera aquifer is comprised of a series of alluvium deposit aquifers that are hydraulically or hydro-geologically connected.
- It can however be divided into three main sections.
- The lowland (delta) segment (70%)
- The Plateau (middle) segment a series of discontinuous alluvium deposit aquifers that are hydraulically connected through the Kagera River and hydrogeologically by flow through fractured Basement
- The highland (upstream) segment is comprised of unconsolidated deposits along the Kagera River course.









Upstream Segment

Alluvium depth 2-8 meters (*variable depth)

Weathered basement layer (variable depth)

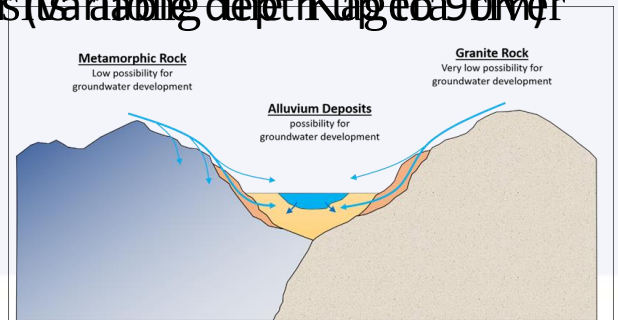
Fractured basement layer (variable depth)

Delta Segment

Alluvium depth 10-80 meters

Weathered basement layer (variable depth)

Fractured basement layer (variable depth)



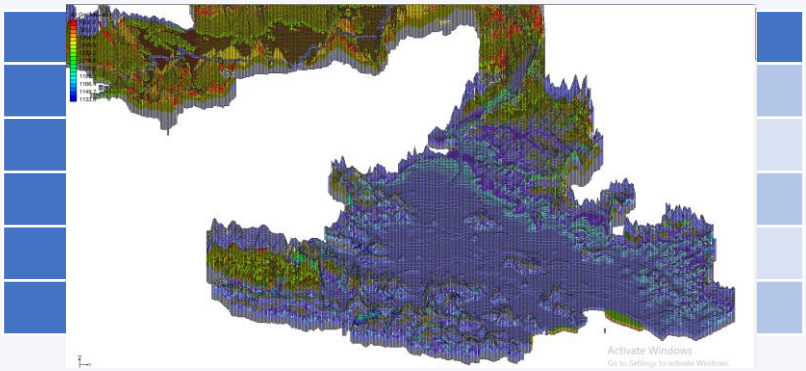
Development Status, Dynamics /Pressures

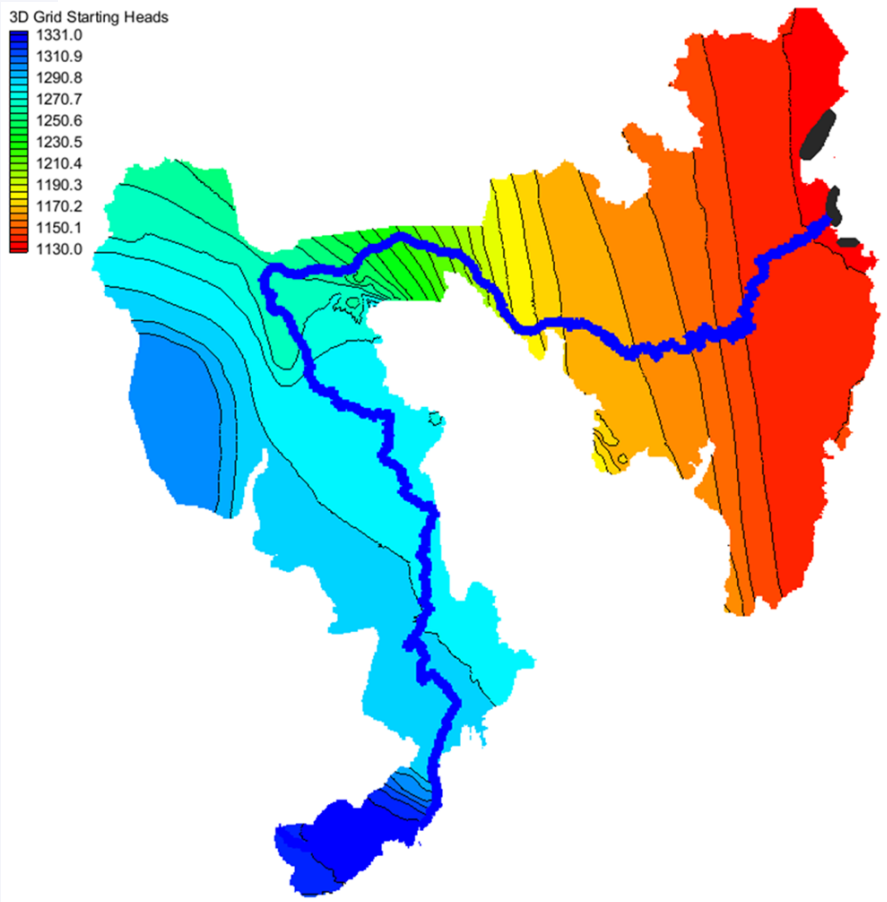
- Population living within the aquifer boundary is estimated to be about 800,000.
- Communities within the aquifer zone are agrarian and they primarily rely on rain and surface water for irrigation.
- Groundwater is utilized with varying degrees for the perennial provision of domestic water supply
- Basic data pertaining to aquifer properties and its current level of development are lacking
- There are no operational monitoring activities within the aquifer.
- Absence of national plans within the riparian countries for the aquifer development.
- Poor public awareness about the susceptibility of groundwater resources to depletion and contamination.

- Rapid Population growth in the area is exerting demographic pressure on natural resources, including groundwater
- The project area is characterized by an unsatisfactory standard of living (including access to water) for the communities.
- Pressure to improve living conditions of the indigenous communities.

Modelling of Kagera Aquifer

A steady state model run was used to establish the system dynamics





The recharge potential was estimated as about 40 MCM/yr wih excess groundwater discharging into the Kagera River

Groundwater Management Issues

- Policies, plans and regulations pertaining to the management of water resources are primarily centered around surface waters.
- Regulations and policies specifically addressing groundwater resources do not usually exist.
- Rules pertaining to groundwater development and protection are usually inferred from those intended for the management of surface water resources.
- Bylaws pertaining to the regulation and licensing of groundwater development are either not fully developed or are not enforced due to budgetary constraints and most importantly the absence of the mechanisms and protocols needed to enforce these regulations if they exist
- Full Participation of primary stakeholders (local communities) in project development, implementation and management is lacking due to legal, institutional or administrative barriers

Institutional Challenges

- Instability of institutions involved in the water sector.
- Overlapping of roles and mandates among different departments & agencies Dispersion of information related to water resources among different institutions.
- Absence of Groundwater Development Strategy and/or Plans

- Weak regulatory role to enforce existing laws and regulations (attributed to underfunding)
- Absence of national database related to water resources in general and groundwater in particular.
- Absence of an effective groundwater monitoring system
- Lack of well-developed training and capacity building plans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