

Water Distribution Systems in Africa: Improving Access for Rural Populations

KELLY L. PETERSEN

THESIS ADVISOR: MARK S. AVNET

DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING, TEXAS A&M UNIVERSITY

Demographics

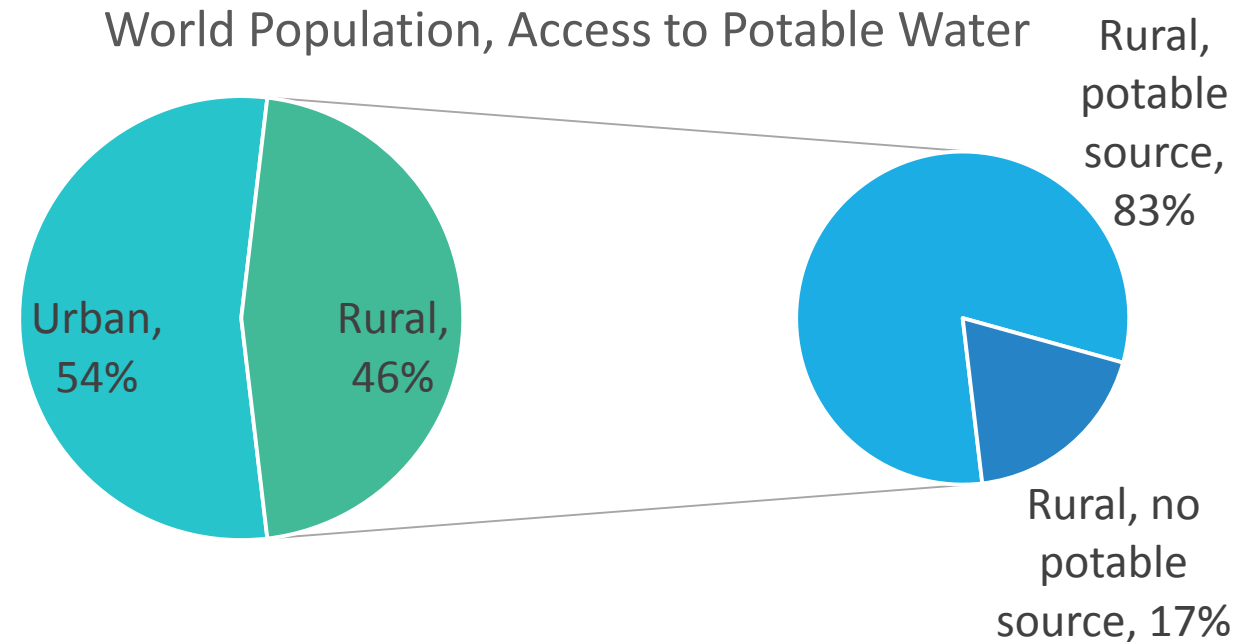
750 million people lack access to clean drinking water

- ~20% of rural population does not have access

Literature interested in how to improve urban drinking water supplies

- Little attention paid to how decisions are made in regards to water usage for rural areas

Goal: Systems level perspective to understand how social, technical, political factors interact during the decision making process

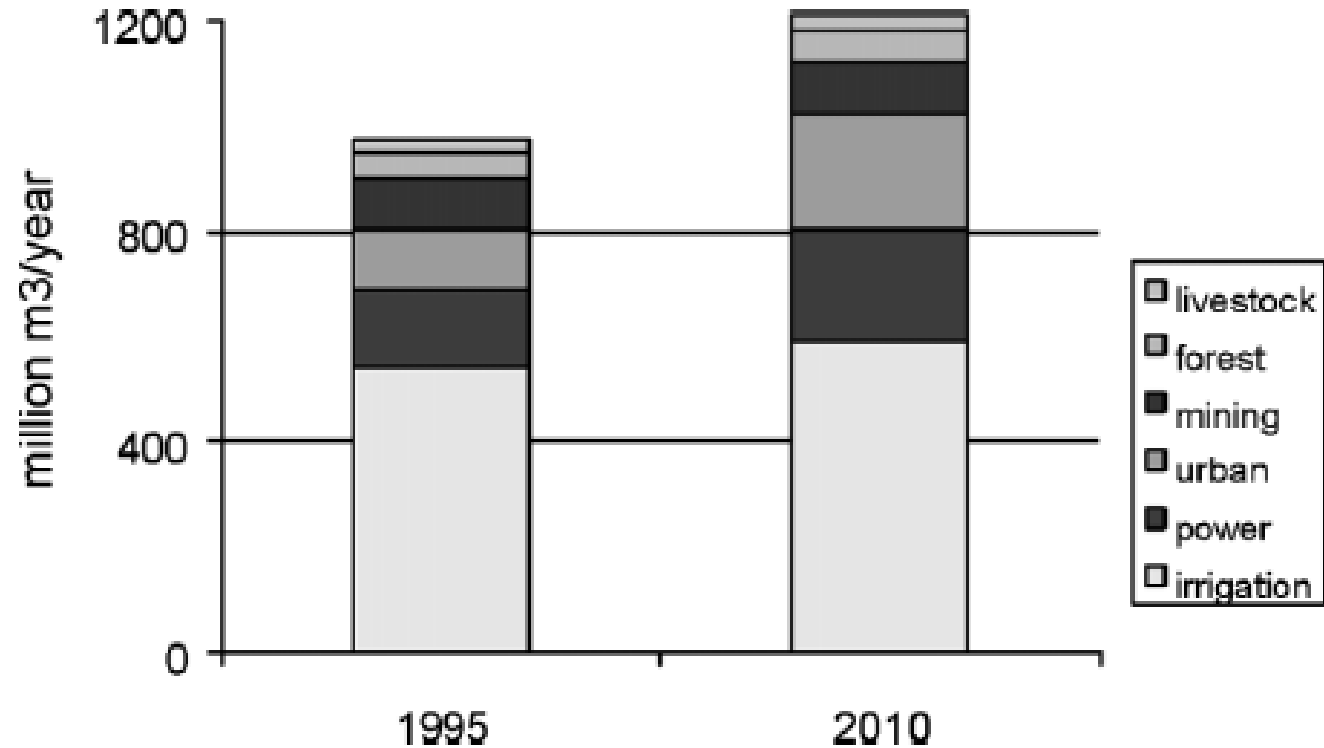


(UN DESA, 2014)

Competing industries and stakeholders

“The serious inequality in access to and control over water and the conflicts between the different uses and users of water lie at the heart of the need for new approaches to water management.” (Wester et al., 2003)

Potable water is one component of a larger system with competing usages



Water Demand by Sector in South Africa,
(Levite & Sally, 2003)

Decentralizing Policy Making

90% of Olifants River Basin population excluded from access to water when allocation was developed

National Water Act of 1998: management by catchment

- Catchment Management Agency seeks agreement on water related matters
- Water User Associations help communities find financial and human resources for water related activities

Role of economics vs. Equity in sharing

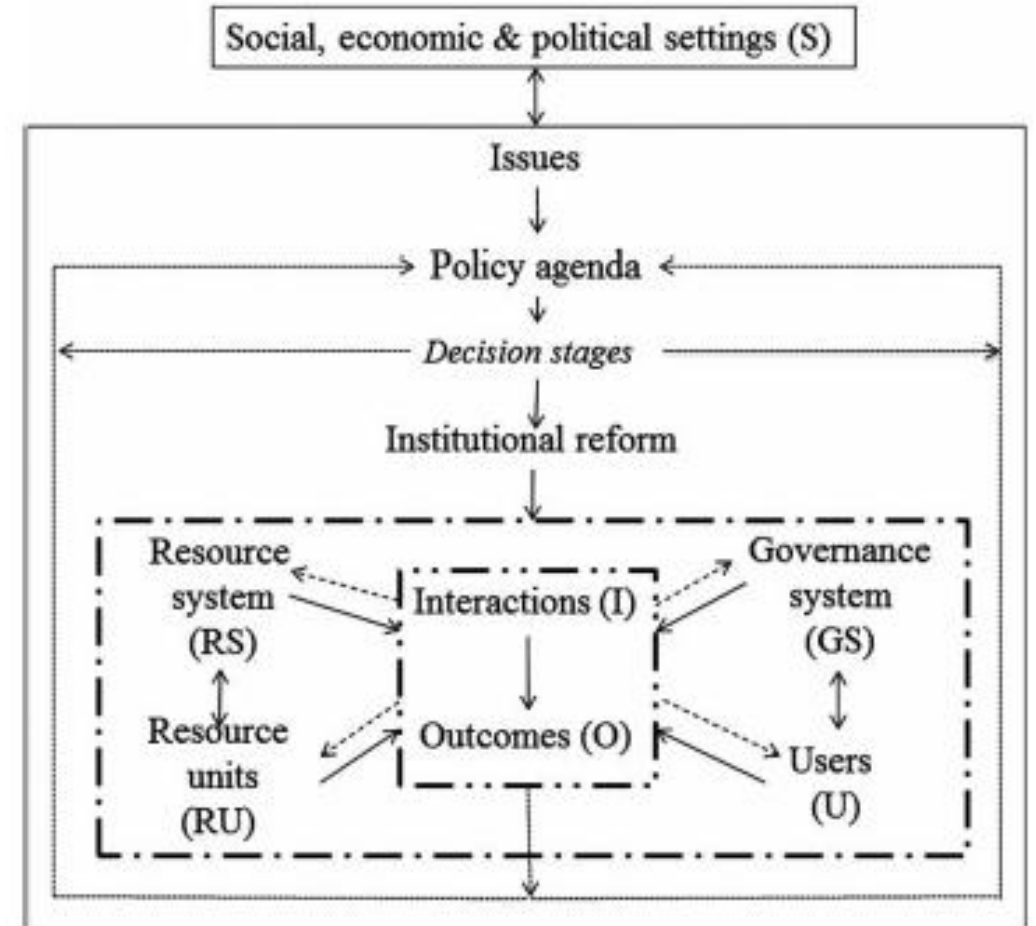


Changing the Way Nicaragua Implements Water Law

Policy design highly centralized, local governments have little input

Proliferation of organizations, lack of coordination, institutional fragmentation, dispersion of responsibilities lead to problems for implementation in Latin America

Inconsistencies between implementation and enforcement



Framework for Analyzing Nicaraguan Water Law Implementation, (Novo et al., 2014)

Research Questions

1. What are the enablers and barriers to the development of potable drinking water systems in rural and developing communities?
2. How can a systems approach be used to understand and resolve conflicting priorities among a complex set of diverse stakeholders?
3. What are the basic principles for translating stakeholder needs into system requirements for the development of complex multi-infrastructure systems?

Methods (1/3): Ethnography, Stakeholder Analysis

Ethnography and Grounded Theory

- Interview policy makers, NGOs, citizens on both decision making and implementation sides
- Identify all stakeholders groups

Stakeholder Analysis

- Classify identified stakeholders based on their demands on the system
- Assess the importance of each stakeholder group on the outcome of the project
- Determine how each group will be affected by the decisions made
- Use stakeholder needs to assess system requirements

After waiting in vain for seven months, Joseph Wachira is now convinced beyond any reasonable doubt that the KPLC is biased against him. And it's because his neighbours who applied for power supply four months after he did have already been sorted out while he remains in the dark. His application is No. E25102005030275.

Eighty-year-old Gideon M'Mbwiria is a well-organised man, who, unfortunately is being frustrated by the Kenya Power and Lighting Company. Gideon applied and paid for electricity connection way back in August last year. But to date, the KPLC office in Meru is still keeping him in the dark despite several assurances when he called personally or sent them notes. The reference number is E25302005080003.

Over a year since J. M. Mwangi applied for electricity at the KPLC's Thika branch office, he is still waiting. And he is not amused that he may be required to pay again for the digging of holes for the electricity poles as those that had been prepared have since filled up with gravel. His application reference is No. E21132005060621. He can be reached on Tel. 0720790411.

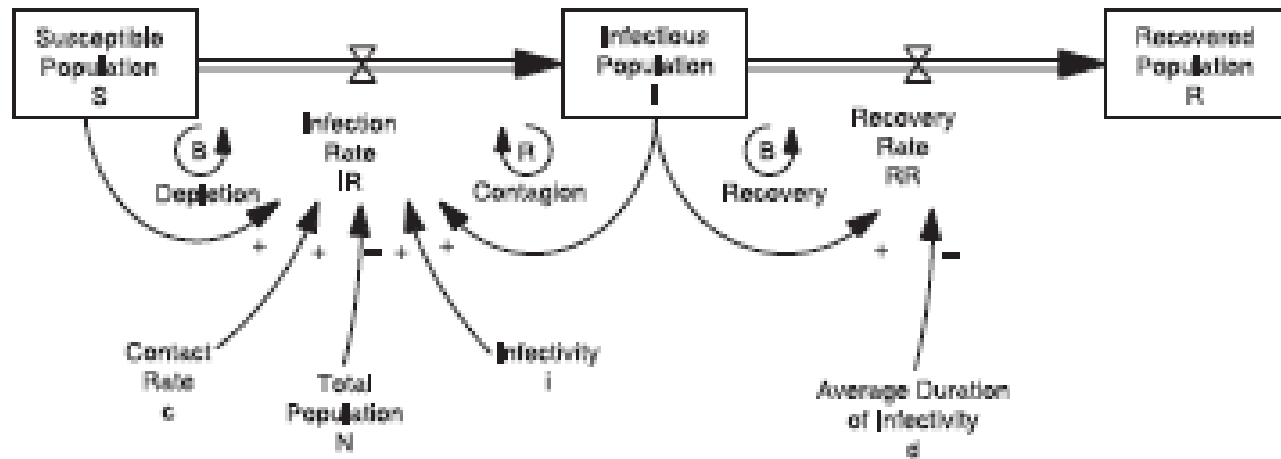
The KPLC staff at Thika are lazy and arrogant, Steve Mwangi claims. "Whenever you ask for any assistance, they do not seem bothered. Worst of all, customers queuing to pay their bills will be left standing without an explanation as the teller disappears behind the counter. Shame on them!" Steve's contact is ssmwangi@yahoo.com.

<delay in connection time>

<perception of KPLC>

Coding from Newspaper Source
(Steel, 2008)

Methods (2/3): System Dynamics Models



Basic Structure of Infectious Disease System Dynamics Model, (Thompson & Duintjer Tebbens, 2008)

SD can be used to understand the dynamic behavior of complex systems by looking at the whole system rather than its parts

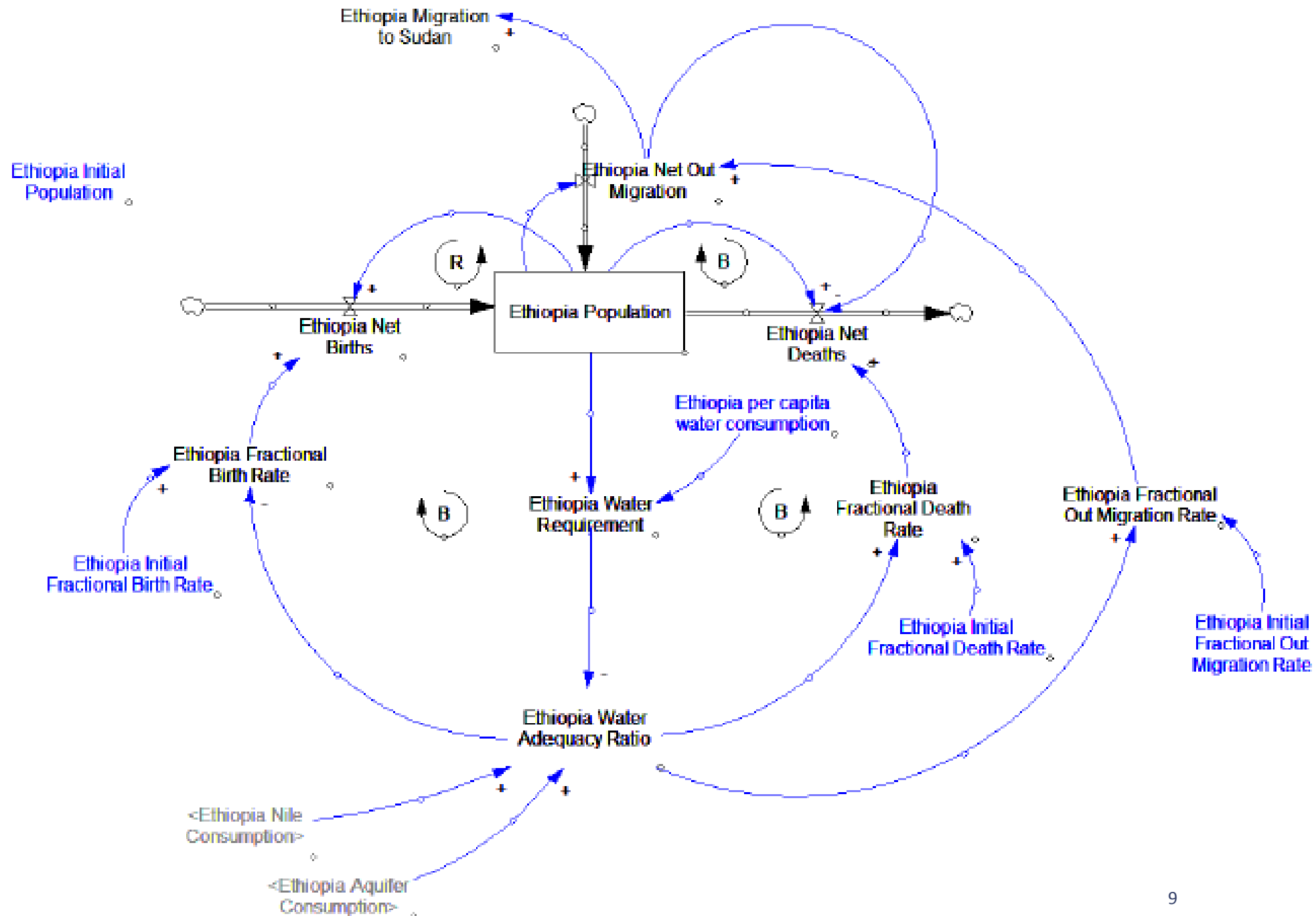
Stocks change over time, flows are the rate of change in a stock

Use data collected from stakeholder analysis to identify relationships between stakeholders and relevant technologies

- Assess long-term, system-wide impacts of decisions
- Explore leverage points
- Communicate with stakeholders

Stock-Flow Diagram for Ethiopian Population

Keith et al., 2003



Outcomes and Vision

Anticipated Outcomes

- Goal: Develop a model that shows the key interactions between stakeholders to determine which have the greatest influence on implementation.
- Identify trends relating to implementation to weigh various policy alternatives
- Determine which relationships need to be strengthened to improve development of systems

Broader Vision

- Aid in delivery of potable water to rural regions
- Establish equitable sharing of resource across usages and stakeholders
- Other contexts: electrification, epidemiology, education, health care
- Water as one component in the water-energy nexus problem
 - Increasing demand for energy, decreasing supply of water

Next Steps

1. Scope research questions
2. Complete literature review on availability of drinking water in rural areas
3. Collect data through interviews with stakeholders involved in the decision making processes
4. Use interviews as inputs to system dynamics modeling
5. Use stakeholder analysis to determine stakeholder needs and develop system requirements

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