Improving Water Resource Management Decision Making through Application of Geo-data in Kenya: The case of Kajiado County

About Watershed

Watershed empowering citizens programme is a strategic partnership between the Dutch Ministry of Foreign Affairs, IRC, Simavi, Wetlands International and Akvo.

Watershed aims at delivering improvements in the governance and management of water, sanitation and hygiene services as well as of the water resources on which they draw.

Watershed is implemented in Kenya, Uganda, Mali, Ghana, Bangladesh and India. The long-term objective of Watershed is improved governance for WASH and IWRM so that all citizens, including the most marginalised, can benefit from sustainable services.

The immediate goal is to enhance citizens' ability to obtain information so that civil society organisations (CSOs) can advocate for change based on reliable, accurate data.

CONTACT: Inyaega@wetlands-eafrica.org

Executive Summary

Kenya is a chronically water scarce country. This means that the demand for water is greater than the renewable freshwater resources that the country can access.

In order to implement the ambitious national socio-economic development strategy in Kenya's Vision 2030, strengthening the resilience of water supply systems, ecosystems and communities depending on these water sources, there is a need for more efficient governance and management of the scarce water resources, including generation and dissemination of timely and reliable water resource data. This data should be readily available and accessible to inform evidence-based decision making.

This briefing paper is part of the outcomes from the *Watershed-empowering citizen's* programme and is a call to action for decision makers, politicians, business leaders and development agencies to ensure that challenges experienced in water resources management are overcome through application of coordinated approaches.

Introduction

Water is a social and economic good, which is critical for the sustainable development of a country. As a social good, water supports domestic needs, life and health, and as an economic good, water supports critical productive activities such as agriculture and industry. Water is a major input in many productive sectors like agriculture, energy, processing and manufacturing, hospitality, mining, construction, and transport. In addition, water provides critical environmental services like support to aquatic life and disposal of residuals (National Water Master Plan, 2013).

Kenya's natural endowment of renewable freshwater is currently at 600 cubic metres per capita per annum. Estimates of water supply in Kenya indicate that only about 56 per cent of the population has access to safe water. Further exploitation of water resources is limited and there is disparity in the distribution of water resources across the country (WASREB, 2019).

Kajiado County (Figure 1) is a particularly water scarce area with a freshwater supply of 162 cubic metres per capita/year (GoK, 2010), which is far below Kenya's above-mentioned endowment. The county has a negative water balance and therefore requires additional efforts to enhance its water availability. This situation is attributed to the fact that most areas in the county are arid and semi-arid with limited water resources. Surface water resources are often seasonal and limited. The county also suffers from frequent drought and flooding events exacerbated by climate change. During the long rainy seasons, extreme heavy rains give rise to bursting of the riverbanks especially in the upper and lower parts. This fluctuation means that groundwater has become the primary source of water in many of the areas for both agricultural and domestic use (Kajiado CIDP, 2018). Moreover, as a result of poor drainage and sanitation within the county, some aquifers within the county suffer high levels of pollution hence contaminating ground water.
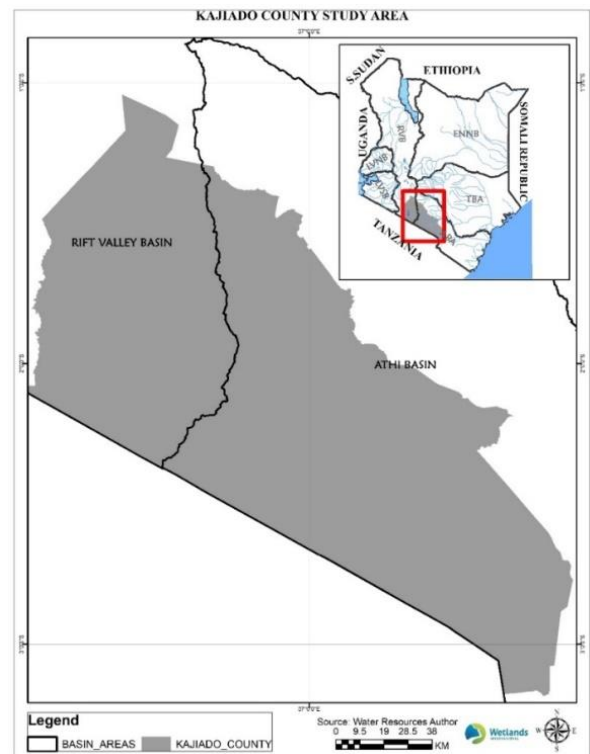

Figure 1: Kajiado County

To address this challenge, Wetlands International together with Neighbours Initiative Alliance (NIA), the Centre for Strategic Planning and Administrative Development (CESPAD), and the county government of Kajiado have been involved in several interventions to map, analyse and disseminate information on water resources management, including water points and water resources in Kajiado County (Jakinda S, 2018). Some of the interventions employed entailed mapping some of the water quality parameters through simulation of hydrological processes within the county, an aspect that provided insights into how land use processes affect water quality. This was particularly important because most of the residents within Kajiado County rely on water from surface runoff and groundwater from boreholes and wells.

Given this experience, this briefing paper lists the findings of using Geographical Information Systems (GIS) techniques to highlight water availability, distribution and use, and further

inform water resource management decision making at local, county and national levels.

Key Findings

To achieve the above objective, the project team designed a flexible methodology that integrated biophysical, social and economic mapping and assessment methods. A 2017 baseline survey conducted by the Watershed programme in Kajiado County identified issues such as population growth, point and non-point source pollution, soil degradation, food insecurity, surface and groundwater quality impairment and weak institutional coordination and governance as some of the key impediments to water security. Solving these water supply and resource problems requires an improved understanding of the fundamental physical, biological, economic and social processes, and knowledge of how all of these components operate together within the catchments.

Given the foregoing, water resource assessment and management require the handling of multiple forms of spatial data. GIS[1] offers powerful tools for the collection, storage, management, and display of information, whereas simulation models can provide decision makers with interactive analysis tools for understanding the physical system and judging how management actions might affect that system (National Research Council 1999). The solutions must serve competing groups of users within Kajiado County, with many of the important hydrologic processes having local, regional, national, and global dimensions. Moreover, it is sometimes difficult to translate research outcomes into policy and management strategies because much of the fundamental research is conducted at specific sites. Conversely, many of the policy and management strategies are focused on catchments and/ or administrative jurisdictions (Figure 1). Additionally, a significant problem of water scarcity and groundwater depletion is that it is difficult to formulate effective policies while there are still numerous gaps in the knowledge of hydrological processes and how different management choices will impact upon these processes (Pavelic et al., 2012). Much of this uncertainty is owing to the complex nature of hydrological systems and the many difficulties in accurately measuring the different components of these systems.

For instance, one of the key findings was that Kajiado County catchments are complex due to the fact that they are transboundary in nature, whereby some of its waters originate from Tanzania within one of its catchments while in another catchment, Kajiado County water drains into Tanzania. While the transboundary nature may not be an isolated phenomenon, it is often a daunting task solving challenges that may be presented at the international level especially through dialogue owing to heterogeneity of policies especially between Kenya and Tanzania for this scenario.

At the lowest level of hydrological modelling, semi-distributed models which incorporate the application of GIS provides insights into the local water balance and how different management decisions and/or climate change impacts patterns of water availability and use. Unique to this study was the establishment of an ecosystem database that would be used to provide inputs for future scenario development and management for decision making to support policy development in light of dynamic land use practices as well as climate change.

---

[1] GIS can be defined simply as software that allows a user to view, store, manipulate and analyse spatial data (National Research Council, 1999)

Recommendations

The study demonstrates that GIS, and more specifically open-source GIS, can be an effective tool for analysing the severity of water scarcity and its impacts on local communities, and for planning possible interventions for improving groundwater recharge and management decisions.

There is also need for improvements which are essential for effective water management. These improvements include:

- Need for increased knowledge on the linkages in the catchment (upstream-downstream dynamics);
- Need for increased understanding of the feedback among processes (institutions, structures and systems) operating at different spatial and temporal scales;
- Need for improved access and use of inexpensive indicators of catchment conditions and qualitative methods to evaluate land use and catchment management practices;
- Need for increased availability of advanced catchment models that can be operated by decision makers who are not scientific experts; and

- Increased understanding of the roles of risk and uncertainty in the decision-making process.
- Need to centralise the relevant socioeconomic, environmental and topographic data currently scattered among different institutions, which will strengthen water resources management capacity. These efforts should be complemented by harmonising collection methodologies, storage and data access related to water.
- Improve communication between data scientists and policy makers, to ensure that decisions contribute to strengthening of adaptive planning efforts.
- Need to employ a multi-stakeholder approach in addressing transboundary challenges with regards to water resources management both at the international and national level.

As part of its implementation, Watershed is contributing towards the above through the WASH/WRM forums at county and sub-county levels and supporting the policy and plan framework development.

References

County, K. (2018). County Integrated Development Plan. *County Government of Kajiado*.

Government of Kenya (GoK). 2010. Environment, Water and Irrigation Sector Report (Final Draft). Nairobi, March 12, 2010.

Jakinda, S (2018) *A case for comprehensive, collaborative, government led water points and water resources mapping for Kajiado County.* Watershed – empowering citizens

Ministry of Environment, Water and Natural Resources (2013). *Kenya National Water Master Plan 2030* Nairobi, Kenya: Ministry of Environment, Water and Natural Resources, Republic of Kenya

Oord, A. (2017). Hydrology and Hydrogeology of Sponge City Kajiado, Kenya. *Acacia Water, 741, 1-7*

WASREB (Government of Kenya Water Services Regulatory Board). (2018). *Impact: a Performance Review of Kenya's Water Services Sector 2017-2018.* Water Services Regulatory Board, Nairobi