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Seasonality, water use and community management of water systems in rural settings: Qualitative evidence from Ghana, Kenya, and Zambia

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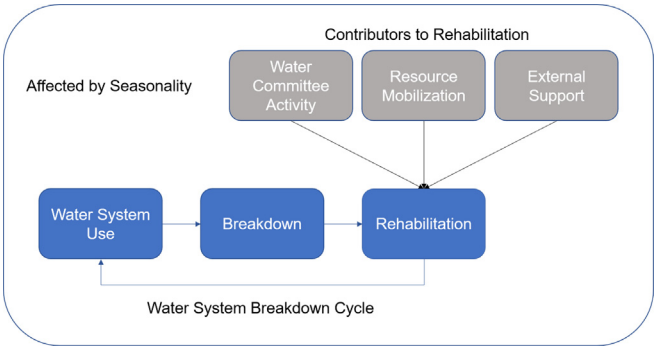
HIGHLIGHTS

- Seasonal availability of surface and rain water affects use of water system.
- Some types of breakdowns are more common in the rainy or the dry season.
- Seasonality affects committee activity, resource mobilization and external support.
- O&M may be more achievable in the dry season.
- Extended, iterative community engagement leads to more effective water committees.

GRAPHICAL ABSTRACT



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ABSTRACT

The sustainability of rural, community-managed water systems in sub-Saharan Africa depends in part on the ability of local water committees to repair breakdowns and carry out the operation and maintenance (O&M) of the system. Much of sub-Saharan Africa has two distinct seasons that affect the availability of water sources and how people use water. Little is known about how seasonality affects water system management. This qualitative study is based on 320 interviews and focus group discussions and examines the effects of season on community water use and management in Ghana, Kenya and Zambia. Participants revealed that seasonality affects water availability, water system breakdowns, resource mobilization, committee activity, and external support availability. In the rainy season, participants typically reported spending less time and money on water collection because rainwater harvesting and seasonal streams, ponds, wells and reservoirs are available. In the dry season, people used improved groundwater sources more often and spent more money and time collecting water. Although seasonal changes in household water demand and use have been examined previously, our data suggest that seasonality also influences community management through differential water system use, system breakdowns and management characteristics. We found that water committees generally have less money, time and access to external support during the rainy season, making them less able to carry out O&M. Our results suggest that community engagement should take place over a long period of time so that seasonal patterns in management can be understood and incorporated into water committee training. External support actors should make a more targeted effort to understand the cultural and economic patterns in a community in order to train committees with appropriate management strategies.

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1. Introduction

An estimated 20% of community handpumps in sub-Saharan Africa are non-functional at any given time (Banks & Furey, 2016) and most system breakdowns occur three to five years after construction. Because all water systems eventually break down, it is important to ensure that water systems are managed effectively and rehabilitations can be carried out quickly. Community management is a common management model in rural sub-Saharan Africa, especially in places where government support for rural water service is lacking (Arlosoroff et al., 1987; Briscoe & de Ferranti, 1988). In this model, a community water committee assumes responsibility for the operation and maintenance (O&M) of a water system installed by an external support actor, such as the government or a non-governmental organization (NGO).

The sustainability of community-managed water systems is dependent on both technical characteristics of the system and the management characteristics of the water committee. Klug et al. (Klug et al., 2017) examined the pathways through which a water committee could successfully rehabilitate a broken-down system, as well as the obstacles which hinder system repairs. The study found that committees could rehabilitate systems through several pathways, but all of these required the mobilization of financial resources and most included support from external support actors. Other studies have emphasized the importance of resource mobilization (Behnke et al., 2017; Smith School Water Programme, 2015), committee activity level (Fisher et al., 2015) and community characteristics such as social capital, sense of ownership and participation (Kelly et al., 2017; Marks et al., 2014; Marks et al., 2013). Sometimes the water committee is not able to carry out repairs, and therefore the importance of accessible external support has been widely recognized in the context of community-managed systems (Bakalian, 2009; Bey et al., 2014; Cronk & Bartram, 2017; Whittington et al., 2009).

Seasonality can also affect the functionality of community-managed water systems in sub-Saharan Africa (White et al., 1972). Most of sub-Saharan Africa experiences a long dry season (ranging from 4 to 11 months/year) where there is less than 25 mm of rainfall per month (MacDonald et al., 2009). There is a substantial decrease in the quantity of water available during the dry season. Groundwater availability (the water source for wells and boreholes) (Eilers et al., 2007) and surface water area (Kaptué et al., 2013) both rapidly decrease in the dry season and rainwater harvesting becomes difficult. Seasonality has been shown to influence water demand in rural households (Calow et al., 2010; Griffin & Chang, 1991), choice of primary water source (Pearson et al., 2016) and willingness to pay for water (Schweitzer et al., 2013). There is little evidence exploring how seasonality affects water system management, especially in the rural community management context.

This study explores how seasonality affects the cycle of use, breakdown and repair for community-managed rural water systems in Ghana, Zambia and Kenya. Although previous studies have identified seasonal variations in water access (Calow et al., 2006), demand (Arouna & Dabbert, 2010; Pearson et al., 2016) and quality (Kumpel et al., 2017), there are no studies which examine the effect of seasonality on management practices. The objective of this study is to describe how seasonality affects community management – including water committees and external support actors – for the first time. We explore the effects of seasonality on community management by examining its effects on a typical water system breakdown and rehabilitation cycle. For both the rainy and dry seasons, we first describe seasonal water system use and its effects on water system breakdowns. We then identify the ways in which both water committees and external support actors respond differently to breakdowns in each season.

This study is part of a larger, hypothesis-generating examination of successful community-managed water systems. It is a common practice in water management research to identify causes of failure. Alternatively, this study examines successful systems because success is not solely the absence of failure. Water system success consists of more factors than functionality alone, and a system that experiences failure can still be considered successful if it is managed such that it can be rehabilitated. Although the qualitative, descriptive nature of this study disallows proof of causality or magnitude of effect, in-depth interviews and FGDs with the users and support actors of successful water systems allow us to learn about previously unidentified relationships. The goal of this study is to describe those relationships so that they may be further examined in larger settings, using quantitative methods.

2. Methods

This study is part of a qualitative exploration of the sustainability of community-managed water systems in sub-Saharan Africa. Eighteen communities were included from Zambia, Ghana and Kenya (six communities in each country). The communities were eligible if they had a successful, community-managed improved water source installed by World Vision. An improved water source is defined as a source that "by the nature of its construction and design adequately protects the source from outside contamination, in particular by fecal matter" (WHO, 2011). Our indicator of "success" was defined as functional at the time of a 2015 monitoring evaluation (Kayser et al., 2015). The improved water sources included in this study were either handpumps or mechanized systems (powered by solar energy or diesel fuel). Water could be accessed either at a communal kiosk or within the household via distribution networks.

Individual interview guides, focus group discussion (FGD) guides and community mapping activities were developed to collect information from community members, community leaders, water committee members and external support actors (Table 1). Full interview and FGD guides are included in the supplementary materials of Behnke et al. (Behnke et al., 2017). External support actors included government entities, non-governmental organizations (NGOs) or private companies outside of the community that provide financial or technical assistance. These groups of stakeholders were selected as study participants in order to gain a balanced and complete understanding of the practical application of the community management model. Community member individual interviews and FGDs aimed to assess how community members contribute to the functionality of the water system, how they benefit from the water system, and how they perceive the water system and the activities of the water committee. Water committee member individual interviews and FGDs aimed to examine water committee knowledge and management techniques, how the committee has overcome obstacles, and what inputs are necessary for continued support of water system functionality. External support actor interviews accompanied insight gained from interviews with water committee members and community members to gain insight as to what external support helps to maintain the functionality of community-managed water systems.

Researchers spent approximately one week in each of the study communities between June and August 2015 conducting interviews, FGDs and mapping activities. The total number of activities conducted

Table 1
List of research activities conducted, with total number of times each type of research activity was conducted – first seen in Behnke et al. (Behnke et al., 2017).

Activity type	Participant(s)	Number of recordings
Individual interviews	Water committee member	92
	World vision staff	34
	Community member	65
	Other local leader	49
	Post-construction support provider	23
Focus group discussions	Water committee members	19
	Community members	20
Grand tour and community mapping		48
Total number of recordings		320
Total hours of recordings		237 h