# WaSH Policy Research Digest

## ISSUE #10, DECEMBER 2018: THE IMPACTS OF SEASONALITY ON RURAL WATER SUPPLY

## Detailed Review of a Recent Publication: Seasonal variations can undermine drinking water quality, availability and management

Kelly, E., Shields, K.F., Cronk, R., Lee, K., Behnke, N., Klug, T., Bartram, J. (2018). Seasonality, water use and community management of water systems in rural settings: Qualitative evidence from Ghana, Kenya, and Zambia. *Science of The Total Environment*, Volumes 628–629, 1 July 2018: 715-721. doi.org/10.1016/j.scitotenv.2018.02.045.

Using data from projects supported by a large international non-governmental organisation (NGO) in Ghana, Kenya and Zambia, Kelly et al. document the struggles that community water committees, set up by the NGO to manage rural handpump water points, face during the rainy season. These include:

- Fewer users because other water sources are available, and users have other options which cost less.
- Less revenue due to both fewer users, and the constraints community members face in making cash payments during the lean period just before the harvest, which follows the rainy season.
- Damage to infrastructure from heavy rains and flooding requiring resources for repairs.
- Fewer committee meetings, and limited availability of committee members who are busy with rainy season agricultural tasks.
- Absence of external support, which is less likely to arrive because of transportation difficulties when roads are impassable.
- In the case of solar pumps, less pumping due to cloud cover, and therefore less water to provide to the community and gain revenue from.

**Key Policy and Programmatic Takeaways**

- The demands on water committees are greater during the rainy season, when their resources, in terms of time and money, are lowest; seasonality thus plays a role in water committee success.
- Governments must manage the inputs of external actors offering support in order to ensure they understand the impact of seasonality, and that they engage and monitor over a full cycle of rainy and dry seasons before proposing management structures.
- Water committees must be able to tailor their management to seasonal realities, such as allowing larger payments after the harvest rather than equal monthly payments year-round.
- Monitoring must be improved to avoid dry season bias and provide a full picture of water access, water use behaviour, and management challenges over the entire seasonal cycle.

The dry season also has challenges, such as damage due to increased use of water points by livestock. It is the rainy season, however, that the authors suggest presents the most challenges for community-based water management.

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The article describes the problems of not taking rainy season realities into account. These occur because much of the external support provided to water committees, especially that of international NGOs, arrives during the dry season when access to remote rural communities is easier. When establishing community water point management, international NGOs risk assuming it will be consistent year-round. These external support actors (ESAs) may dictate rules such as those relating to fee collection and meeting frequency, but may not take seasonality into account.

The authors recommend that a full year of community engagement is needed by external actors to understand local economic and cultural patterns. These should be incorporated into support such as committee training and assistance with the design of water fees. For instance, annual fees levied just after harvest and the use of nonmonetary payment should be considered as alternatives to equal monthly water fees paid in cash. The authors conclude "few ESAs are engaging with communities for enough time". The implication is that community management will falter or fail, and that this will jeopardize the investments made in water infrastructure.

The data used in the analysis were collected exclusively from communities which had a community-managed water point installed by a large US-based NGO. The paper thus primarily reflects the perspective of international NGOs that have time and resources to engage with communities but are not familiar with local realities. It would be interesting to have some insights on whether the same limitations apply to community management set up by local government or by local NGOs; in these cases one would expect a greater depth of knowledge of local seasonal patterns and constraints, though possibly fewer resources to devote to committee training and support. The paper would be strengthened by an explanation of the limitations and bias created by an international NGO focus.

The paper offers some very useful perspectives on the challenges of designing year-round management strategies. It could be argued that some of the issues the authors describe, such as limited time availability of committee members and difficulties with maintaining regular revenue, relate simply to weaknesses of community management; the challenges they observed during the rainy season are somewhat inevitable with volunteer committees organised along traditional community management lines. In a previous issue of the WaSH Policy Research Digest we examined some of these (UNC Water Institute, 2017).

Further research is needed to examine whether other systems, such as service provision by local government or local NGOs, or delegation of management to the local private sector, could overcome some of the limitations described. In addition, more work is needed to identify ways that governments can manage and direct international organisations in order to overcome the challenges they face in adapting to local realities when providing assistance.

*Review prepared by Clarissa Brocklehurst, Adjunct Professor, Department of Environmental Sciences and Engineering, The Water Institute at the University of North Carolina at Chapel Hill.*

## Literature Review: The influence of seasonality on rural water services

Seasonality has long been known to influence water access, quality, and quantity, as shown in the landmark study of domestic water use in East Africa by White, et al. (1972) and further examined in a follow up study by Thompson et al. (2001). More recent evidence presented in the paper reviewed in detail in this Digest shows that seasonality also influences water point management success (Kelly et al. 2018). However, the relationships between these parameters and

seasonality are not well understood, and the impact of seasonality on water services is rarely included or considered in monitoring.

**Seasonality influences water quality.** In their systematic review on seasonal variation of fecal contamination in drinking water sources in developing countries, Kostyla et al. (2015) found that fecal contamination in improved drinking water sources followed a statistically significant seasonal trend of greater contamination during the rainy season. This trend was consistent among different source types, different world climate zones, and in rural and urban settings.

**Seasonality influences water source use and quantity of water used by households.** In the Pacific region, Elliott et al. (2017) showed that the season influenced the type of water source used by households and the relative availability of water from alternative sources. Tucker et al. (2015) showed that in Ethiopia the quantity of water collected varied by season as water sources dried up in the dry season. Year-round, households used similar quantities of water for drinking and cooking, but they used less water for hygiene in the dry season. Pearson et al. (2016) showed that among pastoralist populations in Tanzania and Uganda, seasonal changes meant that over a third of households changed their primary source of drinking water, and households were more likely to switch from a source with higher contamination risk in the rainy season to one with a lower risk of contaminated in the dry season than the other way around. Pearson et al. concluded that "one pathway through which water-related disease prevalence may differ across seasons is the use of water sources with higher risk contamination… even when households have access to likely less contaminated sources (e.g. a borehole), they tend to choose to use other sources, including surface water, when they are available during the wet season". Hadjer et al. (2005) observed in Benin that decreased water availability during the dry season caused household members to travel farther to obtain water, and households used less water per capita. Similar trends were identified through a study in Kenya that used sensor data to remotely monitor handpump use, in which authors identified a 34% reduction in groundwater use in the rainy season compared to the dry season, suggesting an increase in use of surface water sources and rainwater harvesting (Thomson et al., 2019).

**Seasonality influences water service availability and water point sustainability.** In his study on water point functionality using a large dataset compiled across numerous sub-Saharan African countries, Foster (2013) found that handpumps were more likely to be functional in Liberia in the rainy season and more likely to be functional in Uganda during the dry season. Foster suggests that these contrasting findings reflect the different ways that hydrological variability influences handpump sustainability; in the dry season, on the one hand, there may be only one water point available, and therefore there is great incentive to keep the handpump working, while in the rainy season, on the other hand, handpumps do not stop working because of groundwater unavailability. This latter situation corresponds with findings by Kelly et al. and described in the paper reviewed in detail in this issue (Kelly et al., 2018). In their study in Kenya, Foster and Hope (2016) found that people who had access to alternative water sources in the rainy season were less likely to pay for water from their primary water point.

**Seasonality is an important consideration for policy, monitoring, and practice.** The literature shows that seasonality influences water service parameters, including water quality and water availability; as well as behaviors around water source use. This is particularly true of people still relying on lower levels of service such as handpumps, protected wells or springs, which are neither on the household premises nor available when needed, and therefore fall short of the "safely managed" level of service defined by the WHO-UNICEF Joint Monitoring Program for Drinking Water, Sanitation and Hygiene. When seasonal variations result in people reverting to water from unsafe sources, the expected health gains provided

by investments in better water services may be eliminated (Hunter et al., 2009), and progress towards achievement of Sustainable Development Goal (SDG) 6, "universal and equitable access to safe and affordable drinking water for all" is undermined.

The data collected to measure progress towards SDG6 do not necessarily account for seasonal variation in water services. Surveys are more likely to be conducted in the dry season and many thus exhibit "dry season bias". This results in an incomplete picture of access to and use of drinking water services (Wright et al., 2012). Better monitoring is needed that both takes seasonal variations into account in estimating drinking water access, and documents the impacts of seasonality on other parameters. This will allow decision makers to gain a better understanding of:

1) how to ensure households choose to use safe sources throughout the year, and
2) how to make management structures resilient to seasonal changes.

*Literature review prepared by Ryan Cronk, The Water Institute at the University of North Carolina at Chapel Hill.*

# References


Elliott, M., MacDonald, M.C., Chan, T., Kearton, A., Shields, K.F., Bartram, J.K., Hadwen, W.L. (2017). Multiple Household Water Sources and Their Use in Remote Communities With Evidence From Pacific Island Countries. *Water Resources Research, 53(11), 9106–9117.* doi.org/10.1002/2017WR021047.

Foster, T. (2013). Predictors of sustainability for community-managed handpumps in sub-Saharan Africa: evidence from Liberia, Sierra Leone, and Uganda. *Environmental Science & Technology*, 47(21), 12037-12046. doi.org/10.1021/es402086n.

Foster, T., Hope, R. (2016). A multi-decadal and social-ecological systems analysis of community waterpoint payment behaviours in rural Kenya. *Journal of Rural Studies*, 47 (Part A), 85-96. doi.org/10.1016/j.jrurstud.2016.07.026.

Hadjer, K., Klein, T., Schopp, M. (2005). Water consumption embedded in its social context, north-western Benin. *Physics and Chemistry of the Earth*, Parts A/B/C, 30(6-7), 357-364. doi.org/10.1016/j.pce.2005.06.014.

Hunter, P. R., Zmirou-Navier, D., Hartemann, P. (2009). Estimating the impact on health of poor reliability of drinking water interventions in developing countries. *Science of the Total Environment*, 407(8), 2621-2624. doi.org/10.1016/j.scitotenv.2009.01.018.

Kelly, E., Shields, K.F., Cronk, R., Lee, K., Behnke, N., Klug, T., Bartram, J. (2018). Seasonality, water use and community management of water systems in rural settings: Qualitative evidence from Ghana, Kenya, and Zambia. *Science of The Total Environment*, 628–629, 715-721. doi.org/10.1016/j.scitotenv.2018.02.045.

Kostyla, C., Bain, R., Cronk, R., Bartram, J. (2015). Seasonal variation of fecal contamination in drinking water sources in developing countries: A systematic review. *Sci. Total Environ,* 514, 333–343. doi.org/10.1016/j.scitotenv.2015.01.018.

Pearson, A., Zwickle, A., Namanya, J., Rzotkiewicz, A., Mwita, E., Pearson, A.L., Zwickle, A., Namanya, J., Rzotkiewicz, A., Mwita, E. (2016). Seasonal Shifts in Primary Water Source Type: A Comparison of Largely Pastoral Communities in Uganda and Tanzania. *International Journal of Environmental Research and Public Health*, 13(2), 169. doi.org/10.3390/ijerph13020169.

Thompson, J., Porras, I. T., Tumwine, J. K., Mujwahuzi, M. R., Katui-Katua, M., Johnstone, N., & Wood, L. (2001). *Drawers of Water II*. International Institute for Environment and Development, London.

Thomson, P., Bradley, D., Katilu, A., Katuva, J., Lanzoni, M., Koehler, J., & Hope, R. (2019). Rainfall and groundwater use in rural Kenya. *Science of the Total Environment*, 649, 722-730. doi.org/10.1016/j.scitotenv.2018.08.330.

Tucker, J., MacDonald, A., Coulter, L., Calow, R.C. (2015). Household water use, poverty and seasonality: Wealth effects, labour constraints, and minimal consumption in Ethiopia. *Water Resources and Rural Development*, 3, 27–47. doi.org/10.1016/j.wrr.2014.04.001.

UNC Water Institute. (2017). *WaSH Policy Research Digest, Issue #6, Community Management.* https://waterinstitute.unc.edu/files/2015/06/wash-policy-research-digest-6.pdf.

White, G. F., Bradley, D. J., & White, A. U. (1972). Drawers of water: domestic water use in East Africa. University of Chicago Press, Chicago.

Wright, J. A., Yang, H., Walker, K. (2012). Do international surveys and censuses exhibit 'Dry Season' bias?. *Population, Space and Place*, 18(1), 116-126. doi.org/10.1002/psp.681.