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Household and community-level adaptation to droughts in rural water systems of Costa Rica

BY RÓGER MADRIGAL AND TABARÉ CAPITÁN – DECEMBER 17TH, 2014

Climate change impacts threaten the actual and future achievements to provide safe water in many parts of the world. Drought events are expected to be more intense and prolonged in different areas of Latin American and the Caribbean (LAC), with significant impacts in the volume, timing, and quality of water provided by water suppliers (Kundzewicz & Döll, 2008). Community-based drinking water organizations (CBDWOs) are the most important providers of water in rural areas of LAC and are responsible to cope with future threats due to climate change, besides other non-climatic drivers of change such as demographic growth and land-use change. Their incapacity to adapt would probably lead to uncoordinated responses from households to drought conditions.

In Costa Rica there are nearly 1,500 CBDWOs that provide water to approximate 60% of the population in rural and peri-urban areas, and in many cases operate with minimal governmental support and supervision (AVINA, 2011; Madrigal et al. 2011). Despite some successful examples of performance, most CBDWO are characterized by financial and organizational problems that threatens their ability to cope with external change (Madrigal and Naranjo 2014; ICAA, OPS, and OMS 2002). CBDWO´s inherent capacities to adapt to external drivers of change would be much conditioned by their capacities to initiate and catalyze collective processes in the communities they represent. However, the rich background of historical responses that CBDWOs have given to these phenomena is critical for understanding both the processes and the limitations to adapt to future adverse climatic events.

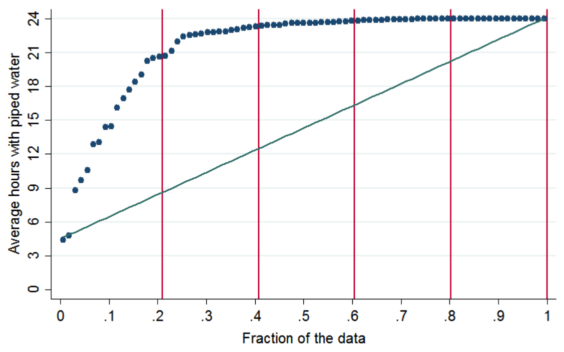
The objective of this research is to have a better understanding of the adaptive capacity of rural villagers and CBDWOs to seasonal droughts threatening drinking water availability in their communities. Using survey based data on historical responses to seasonal droughts from 81 communities in the driest area of Costa Rica, we characterize the adaptive measures implemented at the household and community level to satisfy the needs of rural consumers of drinking water. The research also explores the main factors facilitating their implementation as well as the relationship between adaptation at the community and household level.

Key Points

- Water meters are associated to efficient water allocation
- Differences in performance and adaptive capacity of CBDWOs tend to be associated with characteristics of the governance and financial structure rather than differences in water availability at the source
- Financial external support seem to be necessary for adaptation of community water systems
- Using cheap storing devices is the most important coping strategy

As a proxy for performance we use the average quantity of hours of daily service over the last dry season. This information was reported by sampled households in each community. As indicated in Figure 1, a large fraction of CBDWOs provide a fairly continuous water service during the day. The CBDWOs in the higher four quintiles provide water 23.5 hours a day on average. However, the lowest quintile has an average of 14.2 hours and a range of variation from 4.4 to 20.6 hours a day.

Figure 1. Average hours of piped water service by CBDWO during dry season



Despite the relatively low variance in the performance of CBDWOs, there are some salient differences that tend to characterize the group of CBDWOs with higher performance (i.e. the higher four quintiles) and the group of CBDWOs with lower performance (i.e. the lowest quintile).
The existence of metering systems at home seems to be a positive factor associated with high-performing communities. 85% of high-performing CBDWO have metering systems installed in all houses while only 25% of CBDWO with lower levels of performance have this technology. This feature allows to charge volumetric water fees and hence, it might create the appropriate economic signals to limit excessive water consumption and to repair intra-household pipe leaks.
Despite being located in the driest region of Costa Rica, water availability at the source is not a limiting factor for most CBDWOs. The technical evaluation of the water systems show that for 90% of CBDWOs water availability at the source is sufficient to satisfy the needs of actual populations in the communities. This is also confirmed by the opinion of CBDWO´s leaders on water availability on existing wells to cover demand. Only in one quarter of low-performing communities, water is not enough to satisfy the needs of households. This suggests that for the rest of low-performing CBDWOs, organizational and financial problems might limit their capacity to coordinate preventive and corrective maintenance and develop investments plans, among other important tasks, to distribute water efficiently across households.
There are important differences in financial indicators between high and low-performing CBDWOs. First, high-performing tend to be more efficient collecting monthly water fees since they have 10.1% of water bills delinquency compared to 15.9% in low-performing. The reason why this is happening might be associated to a perverse circle between low performance, lack of funds to manage the water system and unwillingness to pay for an unreliable service. In addition, it might be also related to the incapacity of the local committee to enforce sanctions to water debtors.
Second, high-performing communities tend to have more funds compare to that of low-performing. For instance, high-performing CBDWOs collected more than twice the total amount of money raised by low-performing CBDWOs through monthly water fees. This is partially due to scale differences since high-performing have 191 connections (households) on average compare to 123 connections on average in low-performing. Nevertheless, correcting by this factor important differences still persist. High-performing are able to collect a monthly average of 10.9 US$ per-household while low-performing only collect 7.6 US$. Interestingly, these differences do not seem to be associated to differences in wealth among people in these communities.
Third, expenditures in electricity bills due to the functioning of water pumps tends to be very similar between high and low-performing CBDWOs. However, given the stark differences in revenues, these expenditures represent nearly 50% of total incomes in low-performing CBDWOs while in high-performing stand for around 25% of total income. It is very likely that this situation affects savings as well. In fact, high-performing CBDWOs reported average savings of 7,878.9 US$ while low-performing reported only 1,538 US$ at the moment of the interview. On

average, CBDWOs have implemented three different adaptation measures over the last 10 years. Nearly half of these adaptations tend to be investments in infrastructure, particularly improvements in distribution networks. There are some differences between high and low-performing CBDWOs in this respect. 58% of high-performing have implemented metering systems to regulate demand, while only 35% of low-performing have opted for this option. It seems that supply side solutions are preferred by low-performing CBDWOs since 53% have invested in additional water sources while only 28% of high-performing have chosen this option. Finally, there is a tendency of low-performing to depend more on soft adaptation measures. Particularly rationing and prohibitions have been implemented in 65% and 35% of low-performing CBDWOs respectively. These same measures have been used by 22% of high-performing CBDWOs.

Despite the technical complexity involved for the design and construction of hard adaptations measures, only 30% to 50% of these measures have been implemented with external technical support. In addition, it seems that financial external support has been particularly relevant, especially for those investments that tend to be more costly, such as new water sources and storage tanks. This is particularly true for low-performing CBDWOs. The limited capacity of CBDWOs to invest in adaptation might be associated to the perverse circle between low performance, lack of funds to manage the water system and unwillingness to pay for an unreliable service discussed before.

However, this dependence on external support might be also related to moral hazard problems and other perverse incentives. For instance, water tariffs are poorly set to cover the financial costs of capital replacement. This a chronic problem that might have roots in the lack of monitoring to enforce water fees. In addition to the above arguments, in cases where no major investments are needed, it might seem reasonable for some CBDWOs to have water fees just enough to cover operation costs and wait until a critical moment arrives to collect money from the community or elsewhere.

Despite the high quantity of hours of piped water reported by sampled households (as indicated in Figure 1), some households use additional water sources and most importantly, a relatively large number use storing devices to deal with unreliable community piped water service. 28% of households storage water from the pipe. The most common option to store water are buckets of 40 to 60 L capacity, followed by barrels of 200 to 250 L capacity. In all cases, water is mostly allocated to human consumption, cooking and washing.

It seems that the use of storage devices is associated to reported number of piped water by households. Simply put the poorer the capacity of CBDWO to provide water 24 hrs/day, the higher the use of storage devices in that community. The use of storing devices in a very low proportion of households in high performing communities could be interpreted as a safety strategy. In fact, 11% people in these communities reported short critical periods (around a week) where the water system breaks down mostly due to infrastructure damages.

Conclusions

Our analysis suggests that two groups of CBDWOs with different levels of development and challenges exist in the pacific region of Costa Rica. Despite the good outcomes of high-performance CBDWOs, these organizations still need to confront the challenge of infrastructure replacement in the medium and long term. Despite their positive financial statements, savings are not enough to cover such investments. The CBDWO´s with lower levels of performance need to restructure its organizational framework to overcome managerial and financial problems that limit their capacity to provide a fairly continuous service nowadays. Clearly, the degree of vulnerability of this latter group to more severe droughts in near future is much higher and they should be the focus of policy interventions in the short run.

External support seem to be critical for climate change preparedness of CBDWO. Nevertheless, it seems that it requires a long-term integral approach avoiding the tendency to perpetuate their dependency on limited governmental funds and to undermine local incentives to pay for maintenance, replacement and expansion of water infrastructure. This approach should promote the long-term financial sustainability of CBDWOs through improved mechanisms for cost-recovery, accessible financial options and conditioned subsidies. These efforts should be accompanied by reachable opportunities for training in administrative and technical aspects of water management. Finally, the availability of more precise and updated information on how climate change would affect local water systems might be an important pillar in this approach.

The lack of effective adaptation of CBDWOs, expressed by unreliable piped-water systems, would probably lead to more uncoordinated responses of households through coping mechanisms such the use of storing devices and additional water sources for daily needs. It is very likely that these options will entail higher costs to households due to time and resources invested in these activities. These costs and the potential additional costs on health due to accessing water sources of poor quality represent the social costs of community failures to adapt to drier scenarios in existing piped-water systems. The quantification of these costs should provide important information to governments and donors on the value of supporting community efforts to adapt.

ABOUT THIS BRIEF

This brief is based on Madrigal, R & Capitán, T. 2014. Drinking water systems in rural Costa Rica: household and community level adaptations to water scarcity. EfD Working paper.

FURTHER READING

Madrigal, R; Naranjo, M. (2014). Adaptive capacity, drought and the performance of community-based drinking water organizations in Costa Rica. Forthcoming in Climate Change and Water.

Madrigal, R., Alpízar, F., & Schlüter, A. (2011). Determinants of Performance of Community-Based Drinking Water Organizations. World Development, 39(9), 1663–1675. doi:10.1016/j.worlddev.2011.02.011

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