Community Drinking Water Systems: Case Study of Resiliency in Rural Area of Puerto Rico

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Introduction

In September 2017, the archipelago of Puerto Rico was hit by hurricanes Irma and Maria. Partially by Irma on September 6 and two weeks later, on September 20th by Maria, one of the most disastrous hurricanes in the history of the archipelago (Hart, August 28, 2018). Damages caused by Hurricane Maria reached an estimated $100 billion in losses (Caldera-Ortiz, 2017). Among the long-term impacts was damage to the Puerto Rico Aqueducts and Sewers Authority (PRASA) infrastructure, including the threat to Guajataca Dam. In the weeks following Maria, the Dam, located in the northwestern part of the island, was so severely damaged that the local people and governing agencies feared it would collapse. The collapse would have been catastrophic for the approximately 200,000 people served by the Dam, as they faced the threat of losing one of their water sources indefinitely (Primera Hora, January 17, 2019). In contrast to the PRASA infrastructure, there are 240 Puerto Rican communities who manage their own small drinking water systems (CDWS). Many of these systems are located in the mountainous regions of the island (Ríos, 2018) and serve a total of 200,000 people (Ramos, 2015). Around 85% of these systems were operating within three weeks of Hurricane Maria making landfall (Ríos, 2018). These water systems had a rapid response and were fairly resilient during the disaster. Of the 35 systems (15%) that were not working, six suffered damage to their physical infrastructure and the remaining 29 did not have electricity generator capacity to operate (Ríos, 2018).

Theoretical framework

For this study, the resilience of the systems will be measured based on the ability of the systems to "maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity" (Meerow, Newell, and Stults, 2016). The study uses the cycle of disaster (preparation, response, recovery and the mitigation actions for future impacts), to measure resilience.

Research Questions

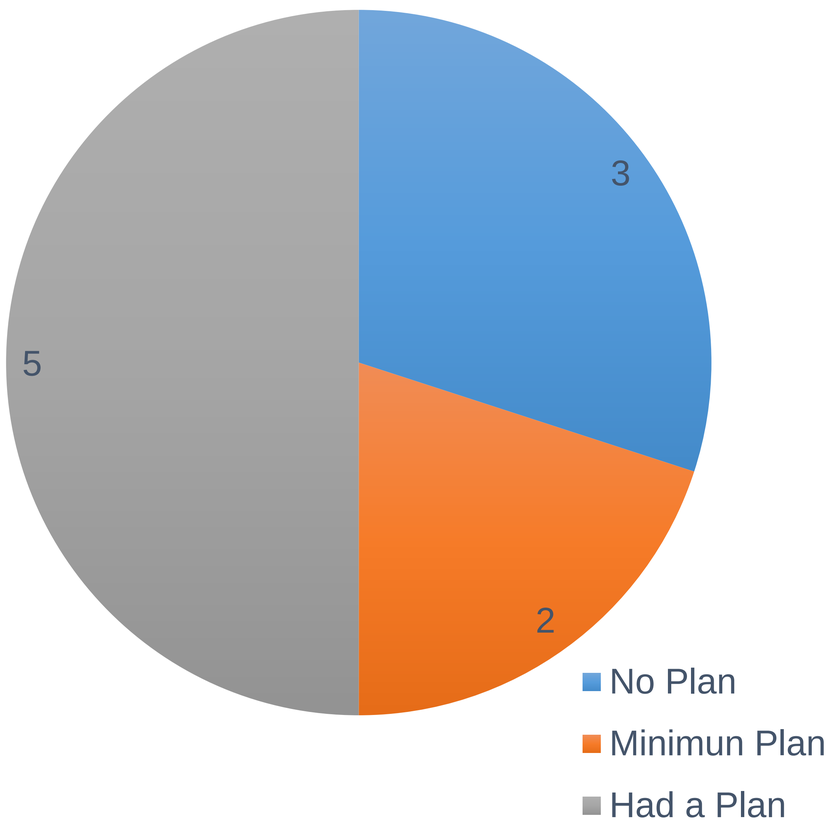
1. Were the CDWS resilient to Hurricane Maria?

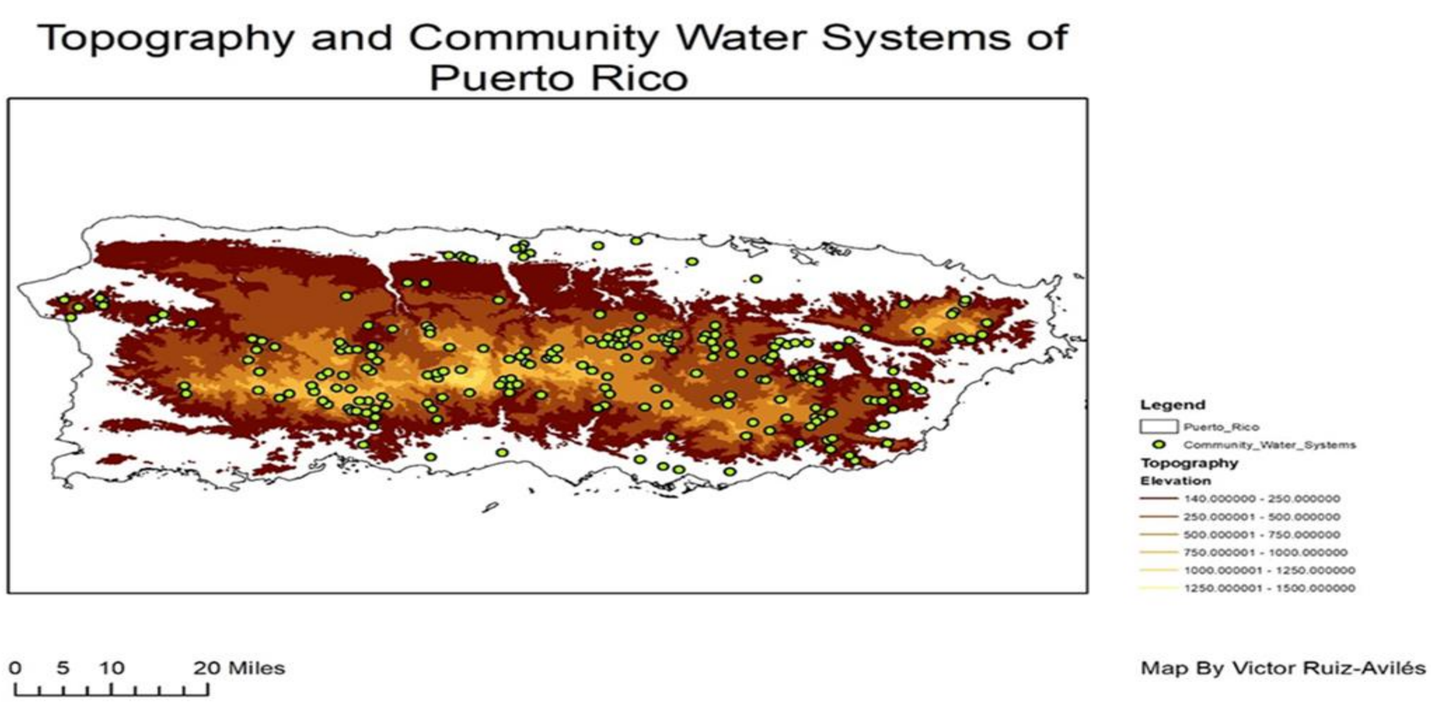
2. Why or why not were the CDWS resilient?

Methodology

- The study used a qualitative approach. There were 10 semi-structured interviews with community managers, five with an external community organization that works with the drinking community water systems.
- The study uses the five geographical regions; north, south, west, east and central and selected one community in two different municipalities per region. One municipality with higher income, the second with the lower income.

Preliminary Results





Response

- Two systems continue serving water
- Two work before the first week
- One Works two weeks after
- Five work in a month or more time

Process

- All of them realized a system access cleanup
- Eight performed visual inspections
- Three bought potable water
- Four had springs

Nine CDWS received aid from external organizations. 8 of them from NGO's and 6 from governmental agencies .

Recovery

- Three systems work independent of energy system
  - ➢ Two made the recovery in two weeks after Maria
  - ➢ One made the recovery in 2 ½ months
- Seven depend on energy
  - ➢ The total recovery occurred when the Puerto Rican Energy Power Authority PREPA brought energy to the systems three to six months after the hurricane

Mitigation

- All of the systems acted in different scales to mitigate future impacts of hurricanes.
- Eight moved the water pipes along a route that made it easier to work on them in the case of ruptures, and are cleaning the areas to reduce the breaks by impacts from vegetation
- 7/10 systems have spare parts
- 3/7 systems that depend on energy have a solar energy systems and 6 have fuel generator
- 5/10 systems receive aid from NGO's and 3 from governmental agency's

Preliminary Conclusion

All of the systems either made, or are making actions to mitigate a future disaster. For that reason, all increased their resiliency to another atmospheric hazard. However, because the communities are in neglected areas, it is necessary to improve the economic income of the systems to create projects that improve the resilience. For example, the CDWS who used to rely on PREPA finished their recuperation process when PREPA began to supply energy on those communities. For that reason its necessary to implement a program to build energy transitions to renewable energy, to make the electric source more redundant to operate the water systems. Another recommendation that various participants made is the need for a systems to accomplish the requirement of incorporation how an NGOs, to receive aid from FEMA, or another agency's emergency funds.

References

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