

# GALAPAGOS REPORT 2011-2012

## HUMAN SYSTEMS

### USES, PERCEPTION AND MANAGEMENT OF WATER IN GALAPAGOS

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*The **Charles Darwin Foundation**, an international non-profit organization registered in Belgium, operates the Charles Darwin Research Station in Puerto Ayora, Santa Cruz Island, Galapagos.*

***Galapagos Conservancy**, based in Fairfax, Virginia USA, is the only US non-profit organization focused exclusively on the long-term protection of the Galapagos Archipelago.*



**Figure 1.** Barefoot man carrying a bottle of purified water up a road in Puerto Villamil. This photo shows that while the population has piped water for domestic uses, for most people the necessity of buying drinking water, sometimes daily, is a reality.

Photograph: Josselin Guyot-Tephany

# Uses, perceptions and management of water in Galapagos

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## Introduction

Residents in the Galapagos Islands have, as yet, no potable water (Figure 1). The implementation of municipal water supply systems increased access to limited water resources, but unlimited population growth has created problems that are difficult to solve: waste of water, contamination of water resources, and water diseases.

Several studies on water management in Galapagos exist from technical and natural science perspectives, but social analyses are needed in order to understand water issues in their entirety. This article presents the results of the survey "Perceptions, uses and management of water in the Galapagos" whose aim was to analyze how the process of geographic opening, a phenomenon defined as the "uncontrolled growing connection of this region with the rest of the world" (Grenier, 2010) affects the relationship the islanders have with water.

## Methodology

The Charles Darwin Foundation (CDF) conducted surveys in the three most populated islands on the practices and perceptions relating to domestic water use: Santa Cruz (N=150, April-May 2010), San Cristóbal (N=100, June 2011), and Isabela (N=70, July 2011). Comparing the numbers of surveys conducted in both ports and highlands of each island with the results of the 2010 Population and Housing Census (CPV - INEC, 2010), we determined that the numbers correspond to the current population distribution. Thus the results can be used to compare urban with rural areas. In addition to obtaining quantitative information, the study involved semi-structured interviews with long-time residents to understand the historical evolution of the relationship between people and water, as well as with institutional stakeholders to define the current model of water resource management in the Galapagos. Methodological details and a thorough analysis of the results can be found in Téphany-Guyot *et al.* (2012).

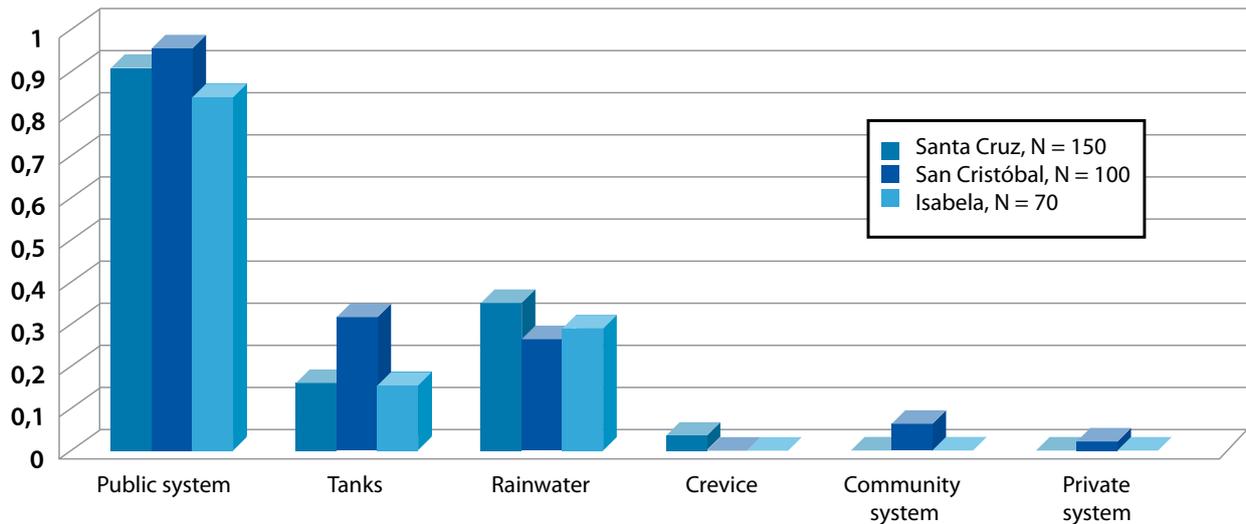
## Overcoming the shortage of natural resources

Until recently, the colonization and development of the Galapagos Islands were limited, mainly due to lack of water. Although the inhabitants of San Cristóbal could count on surface freshwater, the early settlers of Santa Cruz and Isabela survived by collecting rainwater or subsurface brackish water. Beginning in the 1970s, the newly created municipalities began to develop municipal water supply systems. In San Cristóbal they improved the old water distribution system by capturing freshwater in the highlands. In Santa Cruz and Isabela brackish water

distribution systems were implemented by pumping water from the basal aquifer. The municipal water systems provided inhabitants, who were increasingly concentrated in the arid port areas, access to large amounts of water.

Over the past 40 years, municipal water distribution developed so rapidly that most residents are supplied through these systems. In Santa Cruz, 88% of households receive piped water compared to 93% in San Cristóbal and 81% in Isabela (Figure 2). The coverage of this service

is almost complete in the port areas and is well advanced in the highlands of Santa Cruz and San Cristóbal. In the port areas municipal water systems are the only means of water supply for 75% of the inhabitants; receiving piped water in your house is synonymous with comfort and development. Furthermore, it is an affordable service: most people surveyed pay less than US\$10 per month for water, except in Bellavista, where they pay US\$1.21 per cubic meter.



**Figure 2.** Percentage of households that receive water from each means. One household may be supplied by more than one means, so the total may sum to greater than 100%.

As the municipal water system network expanded, traditional water supply practices began to disappear. Less and less rainwater was collected; currently only a third of the households surveyed in the three islands collect rainwater (primarily rural households without access to piped water). Today, rainwater collection is perceived as a necessary solution in rural areas but is disappearing rapidly from the port towns, where this type of water has acquired a negative connotation. Similarly, *in situ* extraction of brackish water in the ports has decreased, with fewer than 4% of the households surveyed in Puerto Ayora and none of those surveyed in Puerto Villamil using this method.

**Waste and shortages of water: supply model paradox**

Distribution of water via pipes and tanker trucks has overcome the scarcity of surface water resources, especially in Santa Cruz and Isabela, facilitating the development of island populations. However, the geographic opening (tourism development and immigration) has created a paradox. On the one hand, urban sprawl prevents municipalities from providing continuous service to everyone in their jurisdiction; facing constant increases in demand, they must resort to water rationing. This situation explains the lack of water to a third

of the households surveyed, which are concentrated in the peripheral areas of the three ports, especially in Puerto Baquerizo Moreno (Figure 3, Maps 1-3). In the highlands of Santa Cruz and Isabela, harvesting rainwater no longer covers the water demand of the local residents, which has increased with lifestyle changes and modernization of agriculture. On the other hand, the pressure on municipal infrastructure (leakage from the water system) and the absence of distribution controls (water meters) are major causes for wasting water. It is estimated that the volume of water wasted or lost in the system is higher than the volume of water actually consumed. In homes where there is good water availability, the abundance of cheap water generates carelessness and wasteful practices. For example, 61% of respondents who have a tank in Santa Cruz, as well as 47% in San Cristóbal and 21% in Isabela, confirm that they allow their tank to overflow once it fills.

**Water uses are determined by its quality**

In the three islands, the water that is distributed to residents by both pipelines and tanker trucks contains pathogens (data from Galapagos National Park Service: Lopez *et al.*, 2005, 2007a, 2007b & 2008; Liu, 2011). Furthermore, in Santa Cruz, the stagnation of water in municipal pipes and poor storage conditions in homes amplify bacterial contamination. This phenomenon probably also occurs in the other islands.

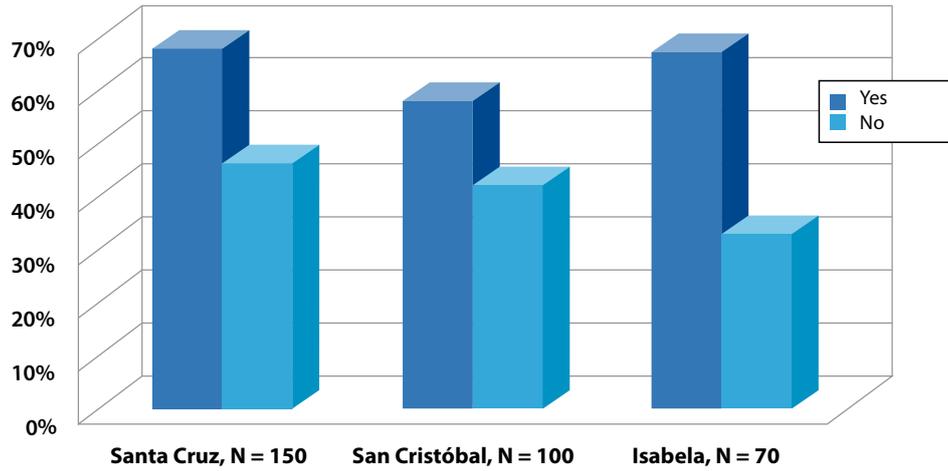
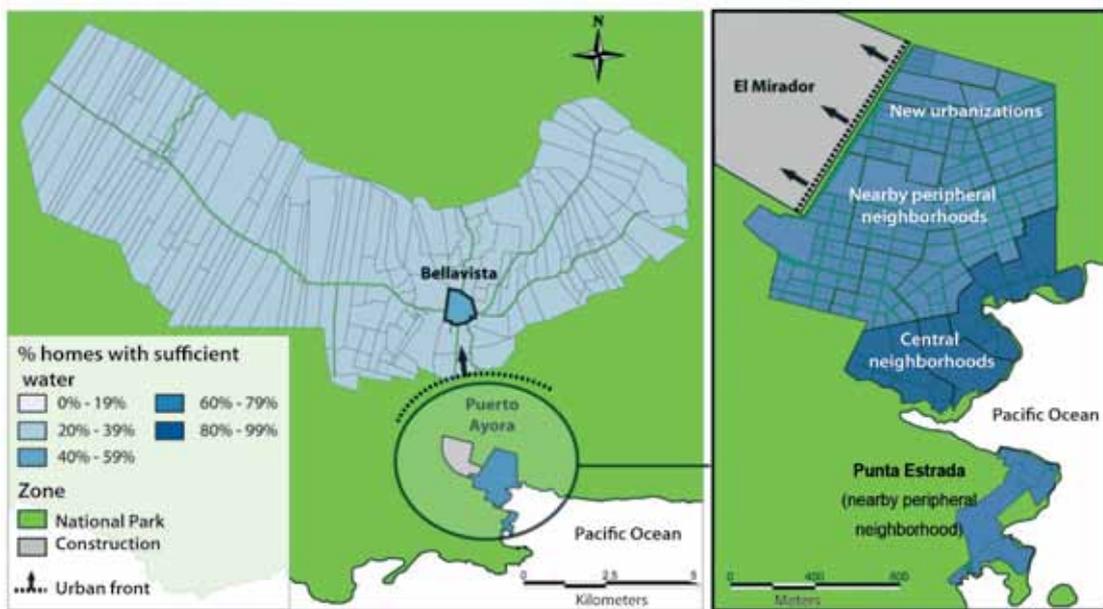
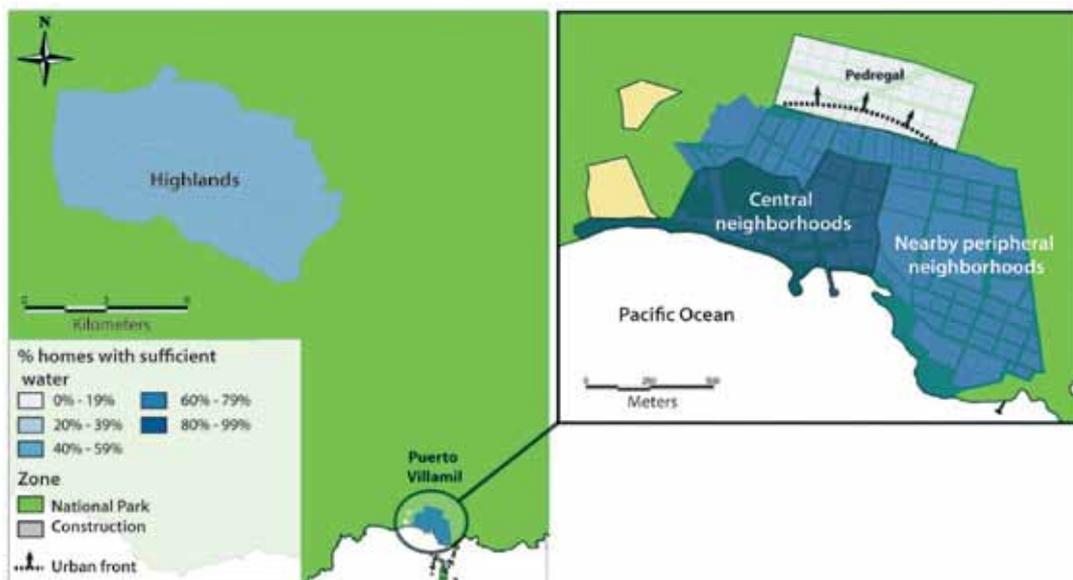


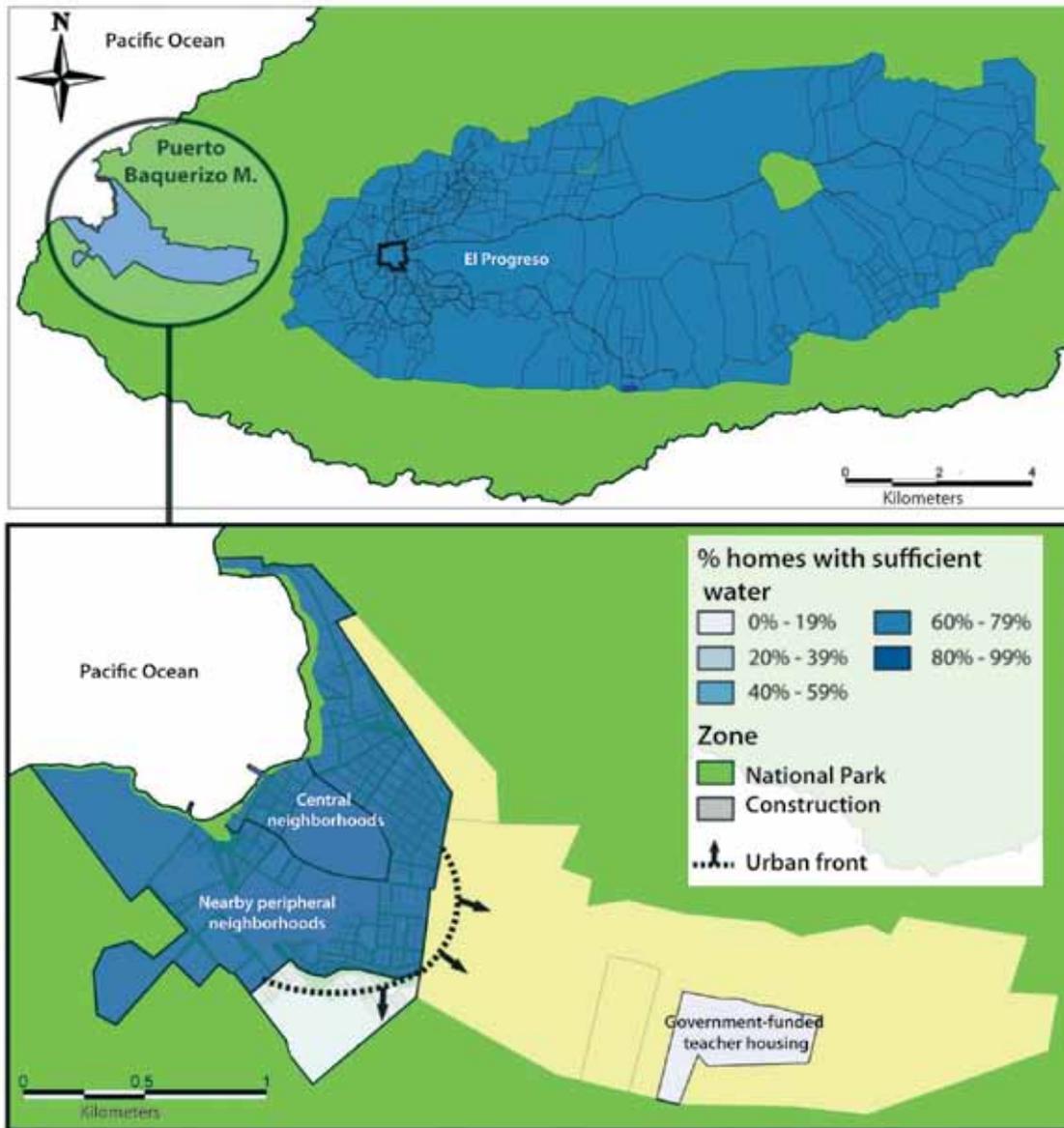
Figure 3. Survey results for the question: Do you have sufficient water in your home?



Map 1. Map showing the availability of water in Santa Cruz. Source: CDF survey "Perceptions, uses and management of water in the Galapagos Islands"



Map 2. Map showing the availability of water in Isabela. Source: CDF survey "Perceptions, uses and management of water in the Galapagos Islands"



**Map 3.** Map showing the availability of water in San Cristóbal. Source: CDF survey “Perceptions, uses and management of water in the Galapagos Islands”

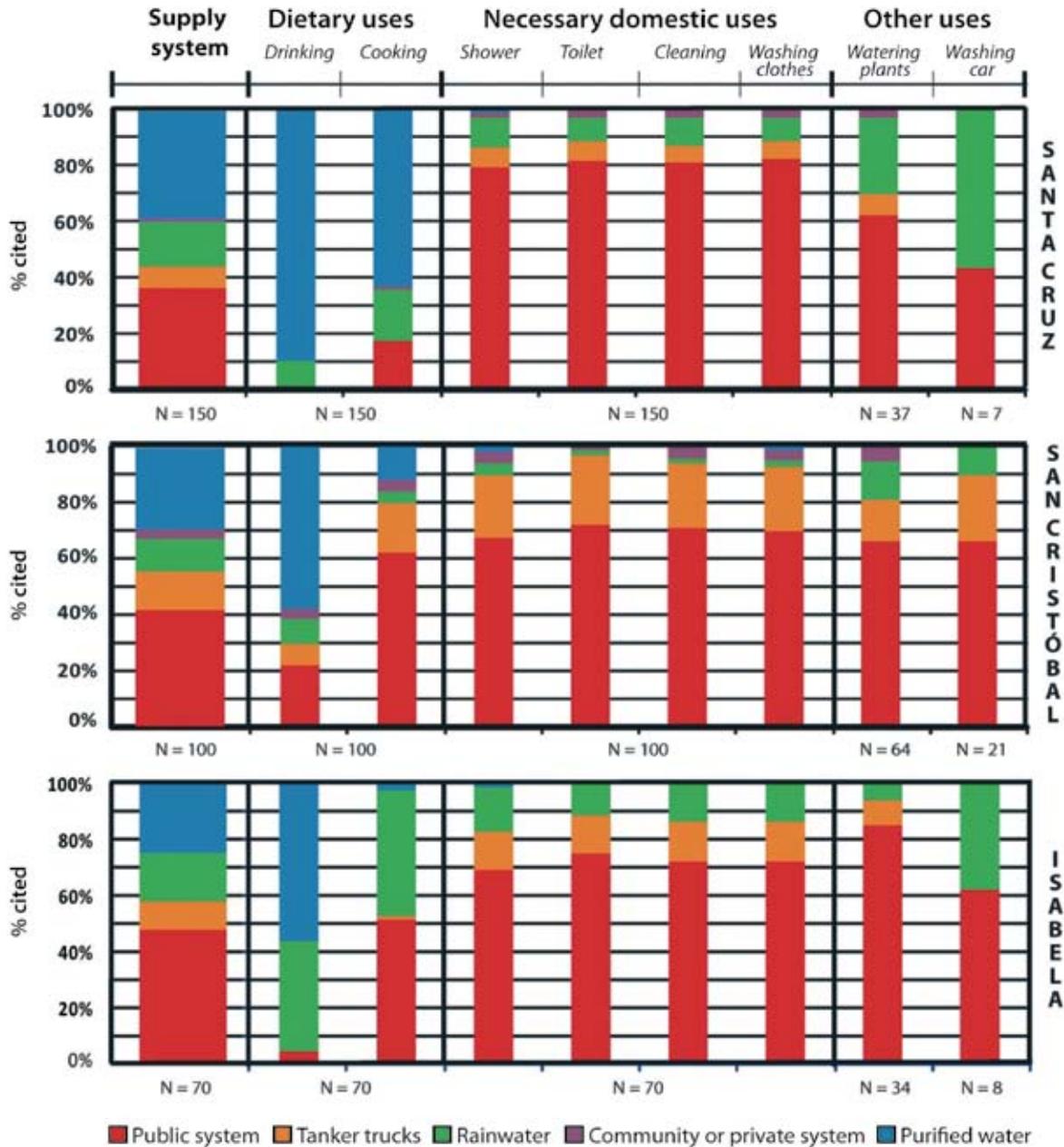
Residents are very concerned with this situation and adjust their water use accordingly. Domestic water use falls into two categories according to the value of the water used (Figure 4). For drinking and cooking, people make an effort to pay for and/or obtain water that is considered fit for human consumption: rainwater, purified water or potable water made at home (boiled water). Piped water or water from tanker trucks and stored in cisterns at each home is used for all other purposes. This water has little economic value and is considered contaminated, which explains why so much is wasted.

Water use in homes is determined by balancing the value of water (economic value and perceived quality) with the ability to use it without significant risk of becoming sick. In the collective mind of the population, there are two kinds of water: water for human consumption and water for other domestic purposes. This difference is expressed

differently in each island: in Santa Cruz and Isabela, people distinguish freshwater from brackish water, while in San Cristóbal they differentiate between drinking water and piped water.

**Water and population: disconnect between inhabitants and their environment**

Although the islands studied have radically different hydrogeology, the inhabitants maintain similar relationships with water. Three quarters of respondents say they cannot use water on their island in the same way as on the mainland (Figure 5). Water contamination and disease are the two main reasons cited, followed by salinity (in Santa Cruz and Isabela) and supply problems (Figure 6). Interestingly, the fact that water is brackish in Santa Cruz and Isabela is now regarded as a problem. In the past it was considered part of the insular identity of



Note: For dietary uses piped water and water from tanker trucks is boiled before use.

Figure 4. Water supply systems and types of water used for domestic use.

both islands. A minority of respondents associates the difference in water use in Galapagos and the mainland with the realities of an insular environment: limited resources (16% of respondents in the three islands) and the need to limit water use in Galapagos (6% in Santa Cruz and 9% in San Cristóbal). In other words, people indicated that they can use as much water as on the continent, but that they cannot use it in the same way due to its poor quality. The first Galapagos settlers' struggle for survival included a daily search for water; today water, albeit of poor quality, is both inexpensive and easily accessible.

### Perceptions, uses and management of water

The geographic opening of the Galapagos Islands

(Grenier, 2010) determines the perceptions, uses and management of water in the archipelago (Figure 7). Intensive exploitation of abundant water resources that were difficult to access in the coastal zones enabled the colonization of the islands, particularly Santa Cruz, the "island without water." The expansion of the municipal water supply systems and the use of tanker trucks are directly related to the loss of traditional water supply methods. Now, with piped water, residents can use as much water as they would anywhere in continental Ecuador.

However, the current model of water management is unsustainable. First, the steady increase in demand due to the geographic opening (immigration and

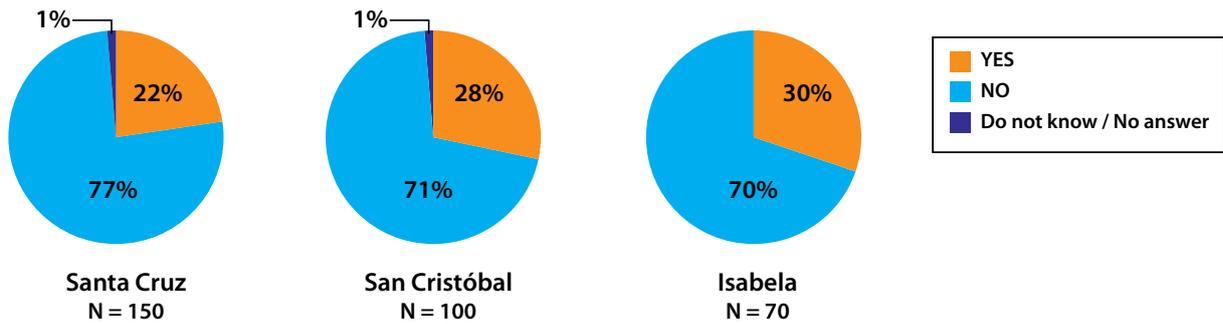


Figure 5. Survey results for the question: Do you think that you can use water in the same form in the islands as on the continent?

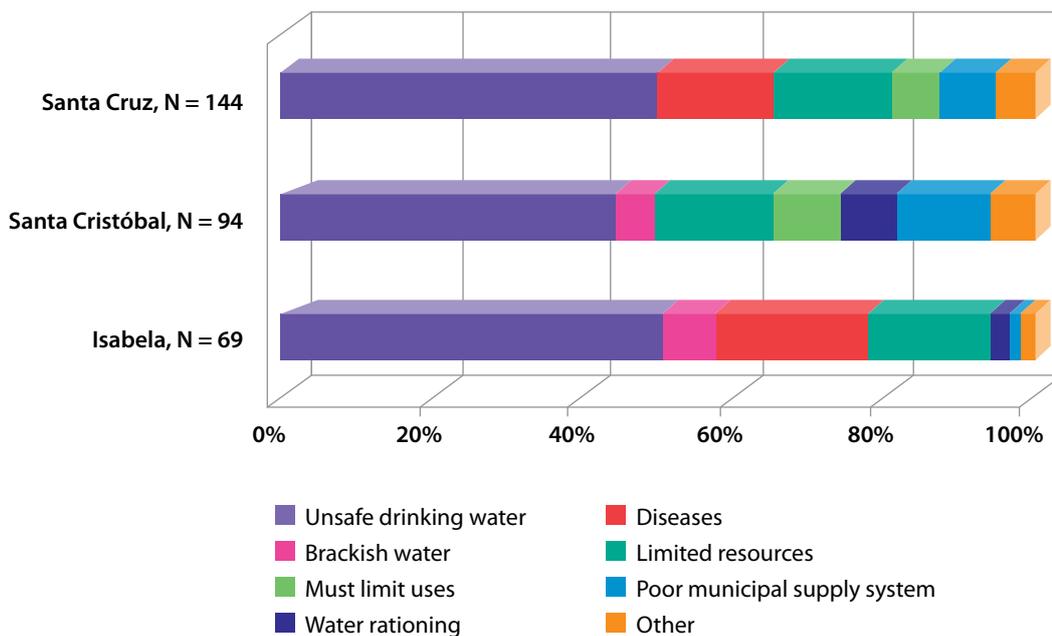


Figure 6. Survey results for the question: why can't you use water in the islands in the same way as on the continent?

continentalization of water use) requires rationing, which increases pollution. Secondly, the current supply model creates a disconnect between the island population and water resources. While residents are concerned about water resources, water distribution via pipes is inexpensive and unmeasured; this leads to indiscriminate, wasteful uses (washing vehicles, watering streets, filling swimming pools, etc.). Negative perceptions regarding the quality of available water reinforce such practices: Why should someone care about reducing consumption when their tap water is barely good enough to wash the dishes?

Over the past 15 years, local authorities have been developing potable water and sewage projects to address the relative scarcity of water, the instability of municipal distribution systems, and water contamination. On the whole, these initiatives have not achieved the desired results, in large part because their design, financing and technology are not adapted to local needs and realities. Moreover, by promoting supply systems similar to those used on the mainland in place of traditional methods, the new model of resource management tends to reinforce

the disconnect between local people and the realities of their environment. The lack of significant improvement at the household level generates pessimism within the local population and has resulted in citizen protests (Figure 8). This situation benefits private stakeholders involved in water distribution (e.g., water purification businesses or suppliers of water purification filters for homes) and increases doubts about the current development model.

### Conclusion and recommendations

Municipal water distribution allowed the development of the island province and particularly of its port areas, which do not have surface water resources. However, the implementation of a continental supply model, coupled with uncontrolled growth, led to the evolution of a relationship between people and water that is poorly adapted to the Galapagos environment. Money and technology will be insufficient to reverse this trend. In order to promote a sustainable model for water resource management, two goals must be achieved: 1) water must once again have a perceived value, and 2) the notion

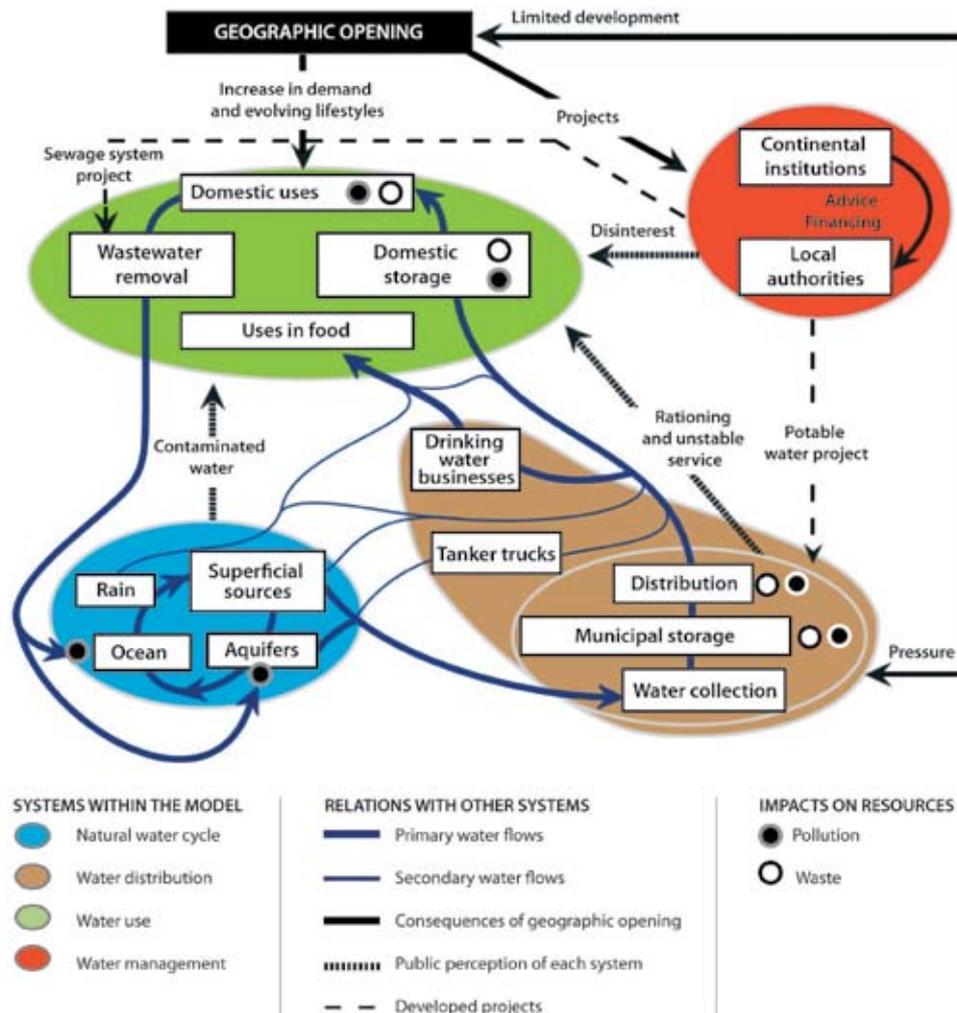


Figure 7. Conceptual model “Perceptions, uses and management of water in Galapagos.”

of limits to water use must be restored. Specifically, we propose the following actions:

- **Promote water supply practices that are adapted to the Islands.** To break the current momentum the community should become re-engaged in the issue of water supply and encouraged, where possible, to establish individual and collective on-site water supplies. In the highlands, where the majority of water resources are concentrated (surface water in San Cristóbal, rainfall and humidity in all inhabited islands), a policy of “water sovereignty” could be developed, based on the collection of rainwater and the capture of garúa or heavy mists. In port areas, water collection could take place at public institutions (hospitals, schools, municipalities), covered public spaces (municipal markets, courts, etc.) and the areas where new houses will be constructed.
- **Promote efficient municipal water distribution.** While it is important to change the supply model, water distribution through pipes will continue to be necessary and such systems need to be improved. Water meters should be installed in all homes connected to the municipal network to control

domestic use. If a proper fee system is established, sufficient funds could be collected to cover operation and maintenance costs of the municipal water distribution system.

- **Promote green solutions to promote a healthy environment.** Sewage is the major source of bacterial contamination of water in Santa Cruz and probably Isabela. The size and expense of sewage system projects currently being developed is such that their success is uncertain. Alternatives based on the separation of wastewater should also be promoted. Grey water can be treated anaerobically and black water treated with dry or bio-digester toilets that do not require water and allow reuse of the organic matter to produce energy or fertilizer for agricultural use.

### Acknowledgments

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**Figure 8.** “March for a more just Galapagos” in Puerto Ayora, May 2011. Photo: Josselin Guyot-Tephany

NB: colors in the photograph were changed to avoid the identification of protest participants.

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**Figure 9.** Water purification plant. Photo: Josselin Guyot-Tephany