



El Porvenir

Agua Limpia para Nicaragua

**Evaluation of fresh water, sanitation, reforestation and
educational coverage of the municipality of el Sauce
for El Porvenir**

Of

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Abstract

For this report a sum of 481 interviews were conducted within three different categories, in the municipality of el Sauce, in February 2017. The data were obtained by a team of local El Porvenir staff, national- and international volunteers. The interviews were analyzed in quantity and quality as well as compared to observations by the research group in the field.

Nine major recommendations and some minor suggestions were developed. Major recommendations were: increase fresh water testing; improve existing water systems; promote more filter systems; encourage formation and education of CAPS (Comite Agua Potable y Saneamiento); implement strategies to deal with the issues of gray waters and trash; improve the setup of latrines to prevent flooding in rainy season; increase efforts to improve coverage of communitarian educators in local communities; redirect resources of the El Porvenir Radio Show in el Sauce; change and improve questionnaire structure for future analysis.

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Introduction

This study was conducted to determine and finally to improve the coverage of fresh water supply, sanitational facilities, reforested areas and educational levels, as well as to access the ongoing and completed projects of El Porvenir, by February 2017. The research objective were the rural communities, as well as the town of "el Sauce", in the department of León, Nicaragua.

The data used for this report, was gathered through small scale interviews, which were conducted by members of the head and local office of El Porvenir, as well as from local and foreign volunteers.

The report consists of four chapters. Chapter one introduces the used research methods. Chapter two covers a general overview over the municipality of el Sauce. Chapter three discusses the obtained data, statistical analysis and related recommendations. Chapter four sums up and presents the conclusions of the conducted research, including recommendation for future current and projects.

Chapter 1: Research Methods

1.1 Interview structure

The data collection was conducted, by using the online application of Magpi (<http://home.magpi.com/>). This application offers the possibility to create an interview layout, which can be used to perform identical interviews in the field. Furthermore, the application stores the answers given by the interviewed. As carrier medium, were Android based tablets and smart phones, used.

The interviews were subdivided into three categories: *Casa*, *Agua* and *Institution*. The majority of the interviews belong to the category *Casa*, which were conducted at random houses in the different communities. To determine the amount of the interviews needed in the different communities, while reflecting the situation in el Sauce as precisely as possible, the sample size was set with a confidence level of 90% and a confidence interval of 5%. Thus, for the given population of el Sauce, of 27900 people, a sum of 268 interviews had to be conducted. This amount was split into the different comarca and communities of el Sauce, by an equal share, regarding their population multiplied by 0.96%. However, the amount of interviews for the categories *Agua* and *Institution* was measured by the sum of public water systems (*Agua*) and local public institutions (*Institution*), like schools, churches, clinics etc., in the respective communities.

Although, it has to be noted that due to the low amount of citizens in some communities, not every single community was visited and therefore, questioned by the team! Furthermore, the interviews of the categories *Agua* and *Institution* had to be conducted with a person in charge of the water system or facility. This however, was not always possible and therefore the amount of interviews is lower than planned.

In total, were 268 of 268 interviews at the category *Casa* performed (100%), 133 of 163 at the category *Agua* (82%) and 80 of 148 of the *Institutions* (54%). This sums up to an overall coverage of 83% (Table 1).

In the 268 interviewed households lived 940 persons, which leads to a direct representation-rate of 4,8% of the population of the municipality of el Sauce.

Comarca	Casa	Agua	Institution	Total
El Sauce (Ciudad)	71	0	18	89
Agua Fría El Pílón	14	15	7	36
El Campamento	5	5	5	15
El Salitre	8	4	2	14
La Palma	16	9	4	29
Las Mercedes	11	6	5	22
Los Loros	9	3	5	17
Los Panales	15	19	5	39
Los Tololos	19	8	7	34
Ocotal	10	4	5	19
Rio Grande	15	8	8	31
Sabana Grande	17	4	1	22
Salales	20	12	12	44
San Martín	5	3	2	10
Santa Bárbara	6	10	1	17
Santa Lucia	13	14	6	33
Valle San Antonio	14	9	5	28
Sum	268	133	80	481
Calculated	268	163	148	579
Overall percent	100%	82%	54%	83%

Table 1: Interviews performed in the different comarcas.

1.2 Analysis

The analysis of the different research objectives was performed on the summed up data, of the different comarcas in order to minimize errors. Especially blank data points were a great concern, a wide range of the interviewed could not answer all of the questions. Thus, the strived confidence level of 90% and a confidence interval of 5%, was not achieved.

Furthermore, were the different datasets of the regions compared to each other by percentage not an absolute amount. This measure will help to give a more objective and comparable view of the different communities. To specify, future efforts regarding the work in the communities, both the best and the worst comarcas where highlighted. The ones with the worst situation were highlighted, in order to channel future efforts and to analyze why current projects are not as efficient as in other regions. On the contrary, the comarcas with the best situation are highlighted, in order to use those as examples of good working projects.

For the most parts, the analysis is restricted to the rural areas, due to a very different setting of the town of el Sauce. The differences in of the town and the countryside are too severe to conduct a direct comparison. Therefore, the town of el Sauce is discussed separately in its own section.

Chapter 2: Introduction to el Sauce

The municipality el Sauce is part of the department León in Nicaragua. El Sauce is located 87km northeast of León, between municipalities of Achuapa (León) in the north; Estelí (Estelí), San Nicolás (Estelí), Santa Ros (León) and El Jicaral (León) in the east; Larreynaga (León) in the south and Villa Nueva (Chinandega) in the west. Furthermore, is the municipality of el Sauce divided into the town of el Sauce as well as 16 suburban and rural comarcas (<http://inifom.gob.ni/>).

The terrain is divided into two separate landforms. The planes in the North and Southwest, with an average altitude of 160-200m above sea level. These, are surrounded by the “zone of valleys”, with an average altitude of 200-300m above sea level and an average slope gradient of 15% (El Sauce - un cifras, INIDE Instituto Nacional de Información de Desarrollo, 2008).

El Sauce lies in the dry tropical climate zone, with an annual precipitation rage for 1600-1800mm. Ninety-five percent of the rain falls in winter (May till October), with an annual evaporation of about 1400mm. Annual average temperature is at 26 °C, with a maximum of 32.2 °C in April and a minimum of 24.7°C at the transition of November to December. Relative humidity lies annually by 66.8%, with a minimum in February at 43% and a maximum in September at 88%. Due to this, droughts accrue frequently in the summer months (December to April; https://www.meteoblue.com/en/weather/forecast/modelclimate/el-sauce_nicaragua_3619382).

Chapter 3: Statistical Analysis and Recommendations

This chapter discusses the findings of the survey. Generally are the sections divided in two section Analysis and Recommendations.

Town of el Sauce

The town of el Sauce differs very much from the rural communities and therefore the questionnaire is not suited for this area. All of the barrios have a central water system and therefore, most of the water related questions are irrelevant. Furthermore has el Sauce toilet coverage of 100 percent with 28 percent flush toilets, the rest are latrines. Projects regarding Reforestation are negligible in the town as well.

Regarding the educational coverage and presence of El Porvenir, el Sauce has a special situation as well. Only 37 percent of the people remember an educator or promoter of El Porvenir, this is rather low. However, in the town of el Sauce, other organizations and governmental institutions take over the educational work that El Porvenir does in the rural areas. Therefore, the low percentage is not to consider a problem.

Furthermore, 48 percent of the citizens stated that they were using gas as primary cooking source rather than wood. Therefore, the problem of smoke indicated problems is much lower as well.

In general, it has to be stated that for future interviews the focus should be put onto the rural areas rather than on urban areas! This change would benefit the people and the work El Porvenir does in the rural areas.

3.1.1 Water Coverage: Analysis

For the 16 comarcas and el Sauce were different parameters taken, in order to analyze the water coverage. Those parameters where: primary water source (as well as which organization helped to construct the structure), water quality, amount of used water sources, shortages in summer time, pollution in the rainy season, and use of fresh water treatment.

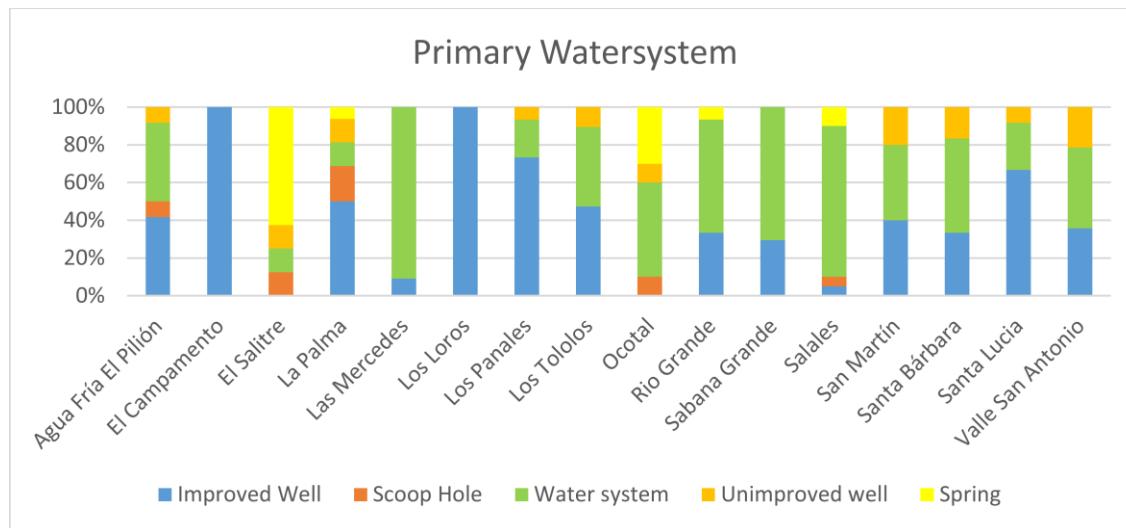


Figure 1: Percentage of the different water sources used in the respective comarcas.

Primary Water Source

As shown in Figure 1, the communities of El Campamento and Los Loros have a full coverage of improved wells. Furthermore, the communities of Las Mercedes and Sabana Grande have a full coverage of a combination of improved wells and gravitational water systems.

On the contrary, El Salitre is the comarca with the worst coverage followed by Ocotal and La Palma. In El Salitre have only 13 percent of the interviewed excess to an improved water system, 13 percent use unimproved wells, 63 percent obtain their water directly from a spring, and 13 percent only excess to water by a scoop hole. In Ocotal use only 50 percent of the interviewed a water system. However, 10 percent use unimproved wells, 30 percent obtain their water directly from a spring, and 10 percent only excess to water by a scoop hole. In La Palma use only 13 percent of the interviewed a water system and 50 percent use improved wells. However, still 6 percent obtain their water directly from a spring, 13 percent of unimproved wells and 16 percent only excess to water by a scoop hole.

Considering this distribution, in combination with the population, 914 people in El Salitre, 483 people in Ocotal and 568 people in La Palma obtain their water form an unprotected source, like scoop hole, unimproved well and springs (Table 2).

For the rest of the comarcas, the combined coverage of water systems and improved wells is over 80 percent, which is consider to be good.

	Unimproved Source	Population	Affected People
El Salitre	87%	1051	914
Ocotal	50%	965	483
La Palma	37%	1534	568

Table 2: Percentage of people using unimproved water sources, population and therefore affected people.

Constructed Water Systems

The interviewed were questioned about which organization has helped them to construct their water systems. Therefore, the percentage of El Porvenir water sources in the regions was determined.

Figure 2 shows the different comarcas and the percentage of the constructed water systems by different organizations. As in the section “Primary Water Source” presented, the regions of El Salitre and Ocotal have a very low percentage of constructed water systems. Equally, the constructed projects of El Porvenir are quite low, 0 percent in El Salitre and 20 percent in Ocotal.

El Campamento has the highest rate of constructed wells by El Porvenir, with 80 percent. This correlates with the 100 percent rate of improved wells form section “Primary Water Source”. Therefore, the impact of El Porvenir on this comarca is clearly visible!

However, 27 percent of the interviewed did not know who helped them to construct their water source. Therefore, over all accuracy is rather low. Furthermore, it is questionable if regions like Santa Barbara, really have a self supported construction rate of 33 percent for an overall rate of 83 percent of improved systems. Considering this, the analysis of this chapter limits to the percentage of El Porvenir structures. This data is considered more valid, out of the following reasons:

1. The El Porvenir structures are rather young. As well as El Porvenir has a continuous presents in the communities after the construction. Therefore, the citizens are more likely to recall the construction.
2. The El Porvenir structures have an imprint in the concrete. Thus, they are obviously assignable.

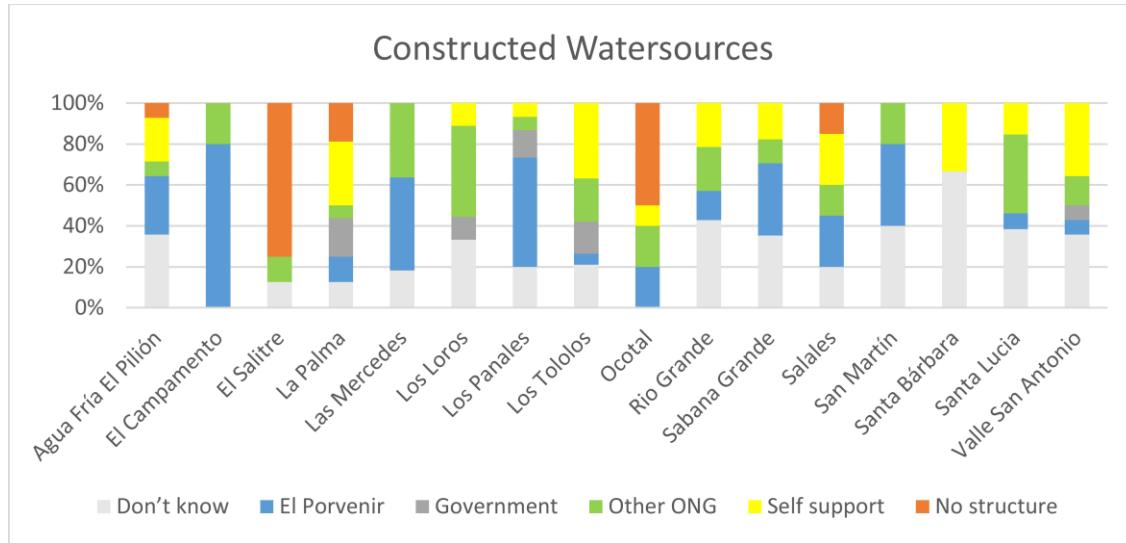


Figure 2: Percentage of the constructed water sources by the respective organisations subdivided in comarcas.

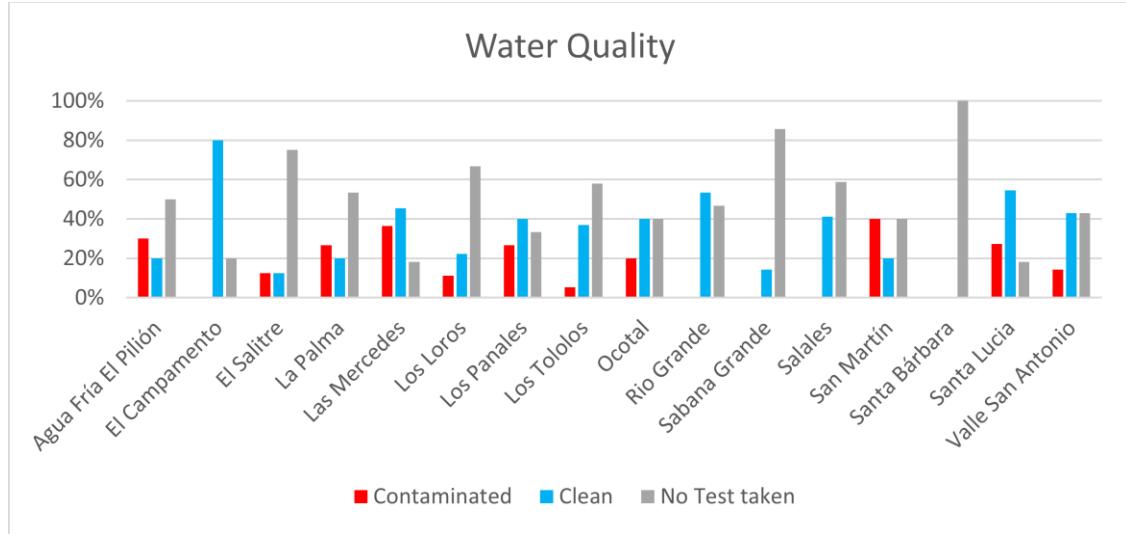


Figure 3: Respective comarcas and their percentage of contaminated, clean and not tested water sources.

Water Quality

In terms of water quality, Figure 3 shows three indicators: clean water, contaminated water and not tested water.

Again, El Campamento is the most positive example. Here, 80 percent of the water systems have clean water and only 20 percent are not tested.

No contamination has been found in El Campamento, Rio Grande, Sabana Grande, Salales and Santa Barbara. Although, except for El Campamento the uncertainty rate, due to not performed tests, is rather high.

Contamination has been found throughout most of the comarcas. The highest (certain) contamination rates have San Martin (40%) and Las Mercedes (36%).

Overall, the findings are questionable (except for el Campamento), because the average rate of not tested water sources is at 50 percent! However, comarcas with a higher amount of El Porvenir constructed water systems, also have higher levels of tested water sources. This is due to the focus of the ongoing monitoring of El Porvenir projects, and is therefore consider as very positive.

Seasonal Water Coverage

Due to strongly arid summers and high precipitation rates in winter times, the seasonal variability is in el Sauce is very high. Therefore, water shortages in the summer and sedimentary pollution of the winters are common.

As shown in Figure 4, the vast majority comarcas have problems with water shortages in the summer, peaking in Los Loros with nearly 89 percent. The lowest rate of shortages in the summer was recorded in both El Campamento and Rio Grande. Most likely due to a shallow groundwater table, indicated by the local river systems.

The highest amount of pollution in winter times has the comarca of el Salitre with 88 percent. The lowest is in Las Mercedes with 20 percent. This is important, as it indicates the possibility of other pollutants (non sedimentary) as well. This is especially important in combination of flooded sanitation systems in the rain season! This is further discussed in section

Toilets.

For both shortage and pollution, the majority lies over 40 percent (except for Rio Grande and Las Mercedes). This is a very high amount and demands improvement for the future!

The two variables, water shortage and pollution are linked to the usage of multiple water sources in the

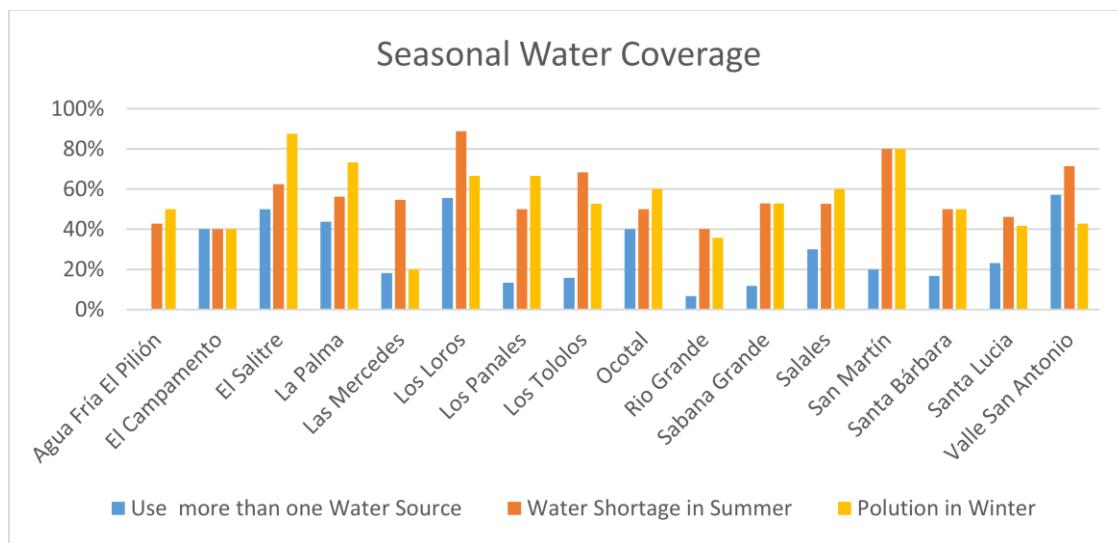


Figure 4: Percentage of citizens using more than one water source all year round, percentage of water shortages in the summer and polution in the winter in the respective comarcas.

communities. Highest is the percentage of multiple used sources in Los Loros and Valle San Antonio with both 57 percent. The lowest is located in Agua Fria / El Pílón, where the entire interviewed claim to obtain all their water from only one source. Another reason for a multiple usage is the contamination of drinking water, as described in section Water Quality. However, the uncertainty about this proxy is too high to make direct indications.

In general, can the proxy “how many wells a community needs”, be used to estimate how well the water systems are constructed. Location, depth and general setting for the constructed water system should be well enough to ensure a year long, clean water supply. Otherwise the citizens are still forced to obtain their water from alternative sources; even if they have a constructed water source in their community!

Freshwater Treatment

Regarding freshwater treatment, the region el Sauce shows two definite trends. As illustrated in Figure 5, predominantly chlorine treatment or no treatment occur. Most of the interviewed stated, that their freshwater was treated with chlorine. Therefore, in all the comarcas at least 50 percent of the water is treated with chlorine. An exception is Ocotá, here was no treatment performed, with a rate of 90 percent, followed by Santa Bárbara (50%) and Salales (45%).

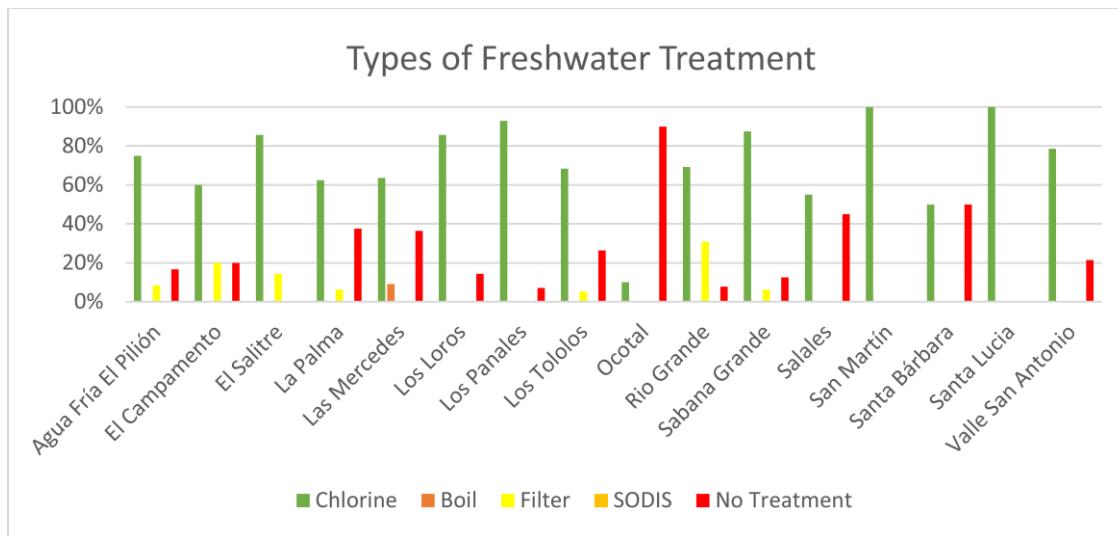


Figure 5: Types of water treatment used in the respective comarcas.

Filters were used the most in Rio Grande, but only by 31 percent of the people. This low coverage will be further discussed in the following section Storage of Drinking Water.

The SODIS method is not used by any of the interviewed. Furthermore, only one interviewed claimed to boil the freshwater before using it. Thus, these methods are to neglect.

During the interviews the team realized that a lot of the interviewed refer to containers with a tap, to poor water, as a filter. This has two negative effects. One is that the cover of filter used in the communities has to be even lower than the analysis shows. Second, that the people do not try to get a filter system, because they believe they already possess one.

Storage of Drinking Water

The usage of a specific container for the storage of drinking water is well established all over the municipality of el Sauce (Figure 6). With the exceptions of El Campamento (80%), Rio Grande (93%) and

Santa Lucia (93%), all the comarcas have coverage of 100 percent. Furthermore, the use of a lid for those containers is very well established. With the exception of Santa Bárbara (still 83%), lies the usage of a lid in all comarcas by over 90 percent, normally at 100 percent.

However, the usage of scooping devices like bowls or buckets lies quite high. It peaks in Las Mercedes with 91 percent and is the lowest in el Campamento with still 25 percent. This lowers the effectiveness of the use of special and closed drinking water containers by far. With the use of a scooping device, pollutants can be transported into the container and thus a contamination can be caused of otherwise clean drinking water!

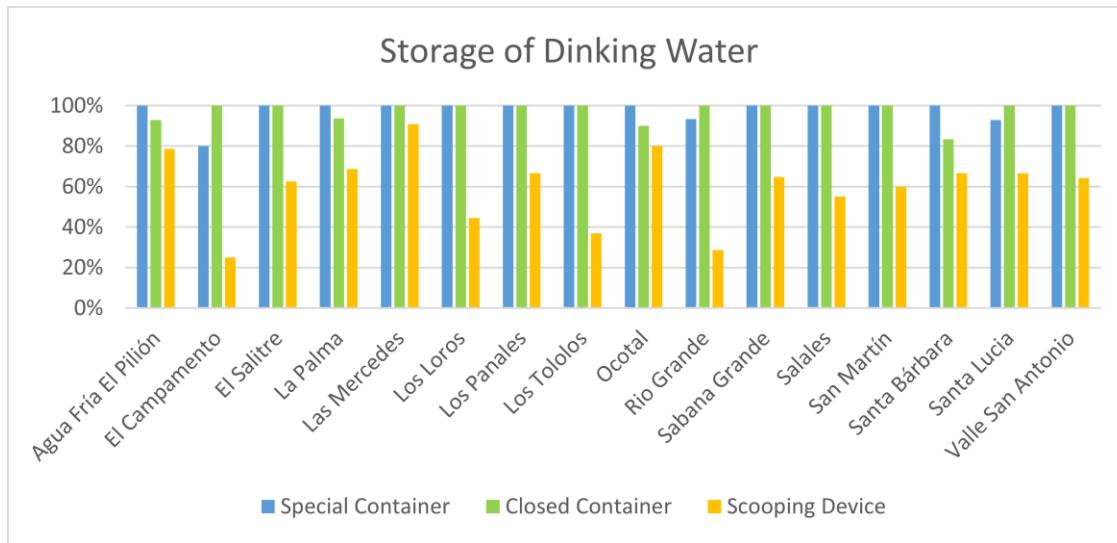


Figure 6: Usage of special containers for drinking water in the respective comarcas.

As explained in the section Freshwater Treatment, a wide range of communities do not have coverage of chlorine of 100 percent as their freshwater treatment. Therefore, the use of tap based pouring methods is even more important!

Comite Agua Potable y Saneamiento (CAPS)

The analyzed data for this section is from a separate interview set (Agua) and differs from the previously used. Although, wide ranges of the interviews are equal to the once discussed in the other sections. Therefore, this section focuses on the CAPS.

Active CAPS

At first, we are going to look at the coverage of active CAPS for the water systems in el Sauce (Figure 7). This category is split up into water systems, which were constructed by El Porvenir and other organizations. For the water systems constructed by El Porvenir, the coverage of CAPS is with 36 percent slightly higher than the once set up by other organizations with 31 percent. However, this five percent difference is still within the margin of

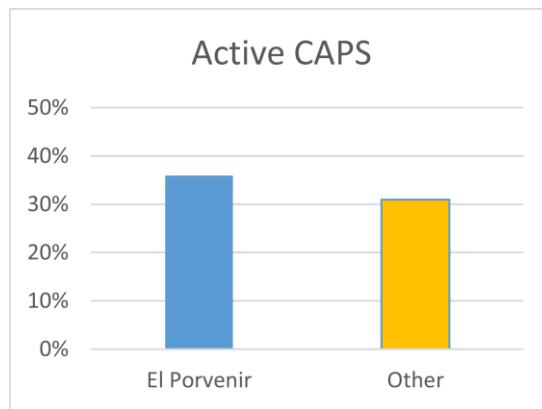


Figure 7: Comparison of percentage of active CAPS at El Porvenir constructed water sources and from others.

error and is therefore not significant. Thus, we can state that El Porvenir does not significantly encourage the communities to set up a CAPS! This is even more surprising, due to the fact that CAPS are mandatory for all water systems, according to Nicaraguan law.

Impact of CAPS

Second the question was raised what kind of influence have the working CAPS on the water systems in comparison to the once without. Therefore, five proxies where taken which were observed by the researchers. These are shown in Figure 8 and are as followed; do the water systems have any kind of structural damages, is the area of the catchment or well clean, are there animals or signs of animals (like excrements) present, do the communities members use the area of the catchment or well for washing or cleaning purposes, and is this area reforested?

For the categories of cleanliness, presence of animals and use for washing porpoises, the differences between active and inactive CAPS are slightly in favor of the once with an active CAPS. Although, the differences are within the margin of error and therefore are not considered to show a trend. The category of reforestation shows even a slight trend in favor of water systems without an active CAPS. Nevertheless, It is not to be estimated that communities without a CAPS would take more care about a reforestation project than the once with CAPS, due to the fact that reforestation projects are very scars in el Sauce in general.

However, the analysis shows a significant difference in terms of occurring structural damages, which can be taken as an indicator for the effectiveness of the performed maintenance. The analysis shows a that CAPS managed water systems have 20% less structural damages (total of 69% without damages) than the once without a CAPS (total of 49% without damages).

Overall, these facts lead to the assumption that the CAPS take mainly care of structure of the water system but less about the overall protection of the catchment. However, this is an essential part of the CAPS!

Water Shortages

Section Seasonal Water Coverage showed that the majority of comarcas have issues with seasonal water shortages in the summer (both with and without CAPS). The interviews with people responsible for the water systems indicated that all water systems which did not serve sufficient water all year long, within

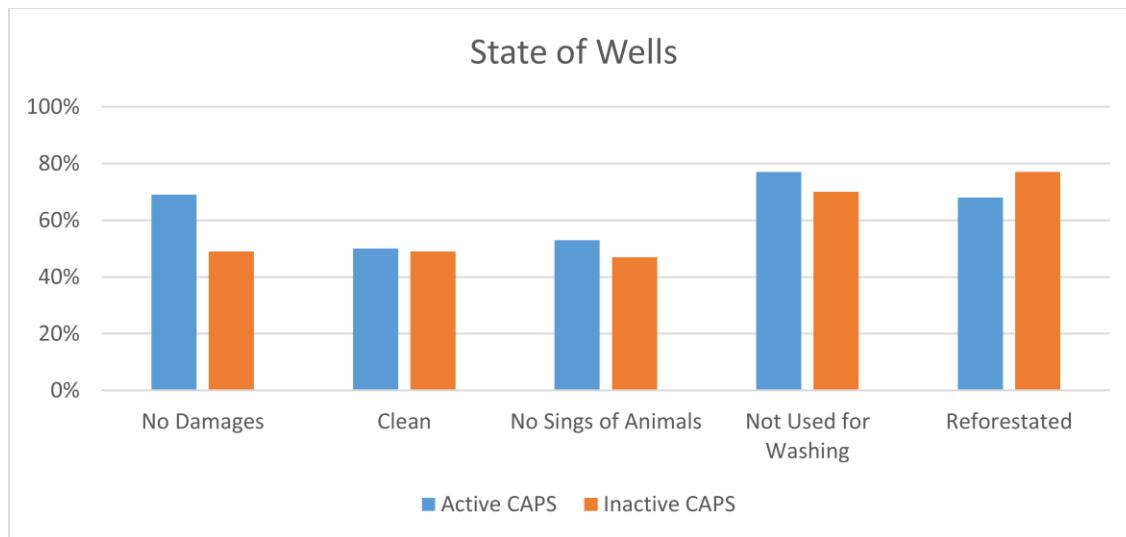


Figure 8: Proxies observed by the team at water systems with active and inactive CAPS.

the last year, had problems with seasonal shortages. Additionally about 10 percent of those had also problems with broken parts at their water system (Figure 9).

This indicates two things:

1. The reparation of structural problems is very well established in the communities.
2. Communities, CAPS and NGOs (including El Porvenir) have to extend their efforts to improve water quantity, by extending reforestation projects and improving water systems.

Problems of Water Systems

The interviewed, responsible for the water systems were questioned about the systems to cross reference the observed states and to quantify differences between El Porvenir structures and others.

The analysis shows (Figure 10) that 41 percent of the El Porvenir constructed systems have no problems at all. Water systems constructed by other organizations lies by 31 percent.

For the analysis of the specific problems Figure 10 shows issues of structural, maintenance, financial, water quantity and quality. The quantified data refers to the sum of systems with problems of either El Porvenir or others.

Structural problems occur at 42 percent of the El Porvenir systems and at 38% of others. Therefore, the structure of the systems build by El Porvenir are respectively more vulnerable to damages. Unfortunately was the amount of data too little to analyze more specifically how the damages occur. Nevertheless, it

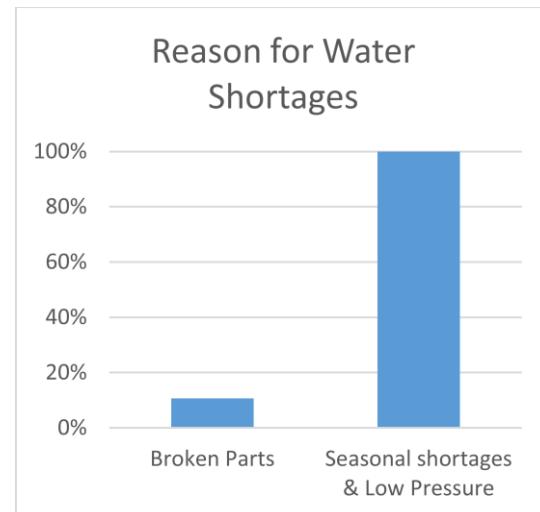


Figure 9: Reasons for water shortages at local water systems.

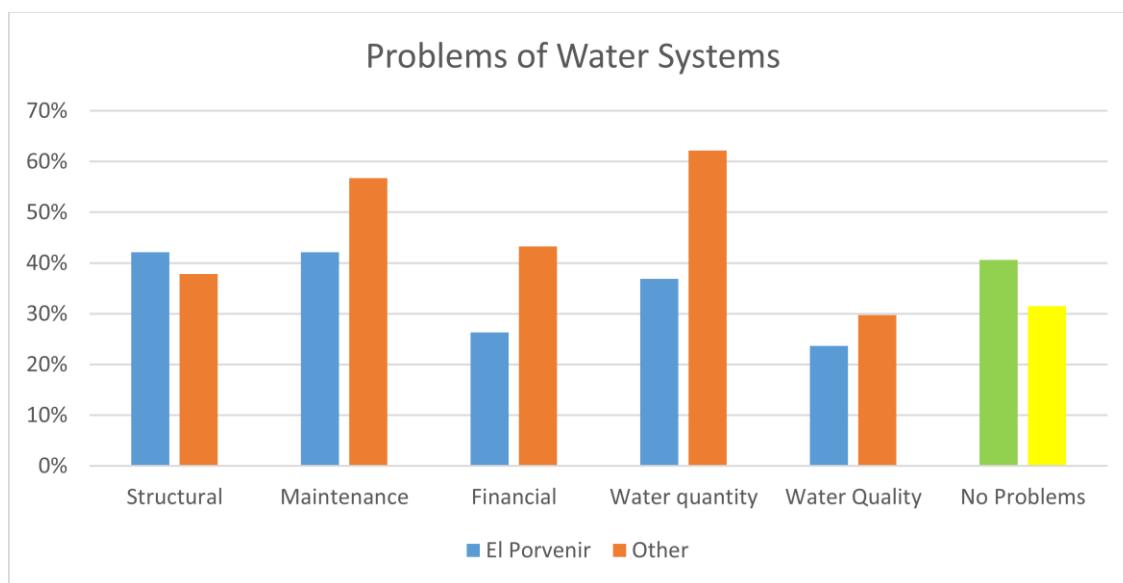


Figure 10: Difference of El Porvenir constructed water systems in comparison to others, in regard of occurring problems.

seems that the tube and cable system is the most vulnerable part of the structure.

Maintenance and financial problems were closely linked by the interviewed. It was often mentioned that failed maintenance was due to a lack of financial assets. In both categories show the El Porvenir based systems a better situation, most likely to better supervision.

Both, problems with water quantity and quality are lower at El Porvenir systems. The sections Seasonal Water Coverage and Water Quality cover these subjects more specific.

3.1.2 Water Coverage: Recommendations

Testing of Freshwater Sources

Clean water is the base for a healthy life, as well as contaminated water is often the cause of sicknesses. Therefore, the certainty of water quality should be a high priority! Thus, more tests should be performed at all the water systems. The percentage of tested systems of El Porvenir is by far higher as the once from others. Nevertheless, I recommend highly extending the testing of both El Porvenir and other systems, so all the people can be certain whether or not they use clean water. Furthermore, should the water be tested at least twice a year, once in the summer and once in the winter. Thus, it can be assured that in both seasons the water quality is known. Especially the high flooding rate of latrines, displayed in section

Toilets makes this even more necessary.

The so obtained data can be used to determine which water systems need attention. Therefore, I recommend to do a separate analysis, specific for the water systems, which are contaminated, to find out why they are contaminated and how the situation can be improved. Especially in the comarcas San Martin and Las Mercedes.

The yearly analysis of one of the municipalities where El Porvenir is active (like this report) would be a great possibility to perform tests at all water systems. In my opinion, this was a missed opportunity during the performance of this research, especially because the last years report of San Lorenzo strongly recommended water quality testing as well!

CAPS

Besides having a better grasp on structural issues the CAPS fail their purpose in el Sauce. Furthermore, is the coverage of CAPS supervised water systems far too low! Therefore it is recommended, to enhance the efforts to promote CAPS in the communities as well as to improve their work. Especially when communitarian educators have such a big presence (compare section Communitarian Educator) it can be estimated that a well-educated and functioning CAPS may have a very positive impact. It might also help do work out some kind of handout what can be given to the people for both causes. I would like to state that I recommend doing this for both El Porvenir projects as well as systems of other organizations!

Another possibility might be to make a formation of a CAPS mandatory, prior to a construction of a water system by El Porvenir. I am aware that their work can not be enforced after the construction but a structure would already be in place to work with.

Figure 11 shall give an example for a bad setting of an El Porvenir well. Some citizens constructed a temporary latrine directly above the well catchment. This demonstrates for once the unawareness of the people how an environment should look like. Furthermore, it shows that a lack of a functioning, educated and aware CAPS or communitarian educator can cause great harm to an otherwise good functioning system.

Freshwater Treatment

The partly, very bad coverage of freshwater treatment in some regions needs attention by El Porvenir. One solution could be to recruit more communitarian educators. Another could be a better working structure of the CAPS, which is more likely to work because a direct application of chlorine at the water system has a wider effect than an application at every single household.

Nevertheless, I highly recommend a wide ranged filter (e.g. ceramic) promotion or program in the communities! This would serve three purposes. One, there is at least one constant treatment source, for example in case the community runs out of chlorine. Second, if there is sedimentary input in the water source it could easily filter this out of the water. And last, most of the used filter systems have also a tap, which consequently solve the problem of most people using a bowl or bucket to scoop water from their container, too.

Construction of Wells

By being in the communities I often felt like there were often new wells constructed close to older ones which did not function or were contaminated. Unfortunately I do not have any hard data to prove this. Nevertheless, I do recommend trying to fix or improve already existing water systems, rather than constructing new ones, both of ecological and economic reasons. Deepening of existing wells, reforestation projects in the catchment area and impermeable latrine pits could be solutions to look into.

Furthermore, some of the constructed water systems (both from El Porvenir and others) seem to lack a well enough preemptive research of the location of the drilling. Although this is also only based on my observations in the field! E.g. Figure 12 shows an improved well by El Porvenir in Hato Viejo in Los Panales. Here the well was constructed on the highest point of the terrain, with lower areas nearby; therefore the shaft was drilled very deep. However, the well only served three years water, but is dry since six years. In addition, the water extracted by the well has a very strong rotten smell, which occurred apparently (quoting the interviewed) soon after it was drilled. This questionable choosing of the setting for a well should be looked into to improve future well constructions!



Figure 11: Displays problems in communities. Latrine was constructed (background) right above the well.



Figure 12: Displays problems with constructed wells. It was constructed at the highest point in the surrounding area; water has a rotten smell and went fry three years after construction.

most regions an unrealistic goal. However, bio-filters show highly promising effects on the treatment of gray waters. Even though their need for maintenance is quite high, their cleaning is rather effective, they are cheap and the produced biomass which can be transformed into fertilizers.

Trash is a universal problem in all the comarcas, in el Sauce as well as in the majority of rural regions I visited all over the globe, especially in terms of plastic. First, there is the problem of accumulation of trash in general and the lack of collection after usage. This leads to a superficial pollution in the communities. Primarily those accumulations can be a nursing ground for vermin and diseases. However, to remove this problem the majority of people burn the trash. This may solve the problem of vermin and current sources of diseases, but it also produces new problems. One is the production of highly harmful smoke, usually right next to the households of the citizens. Another is the accumulation of pollutants in the ash and therefore later in soil, crops, stock, ground and water. In comparison to other pollutants, these have rather slow occurring effects like heart disease, cancer and infertility. Furthermore, the filtration of those pollutants is difficult, especially when implemented in the food chain. Thus, a preemptive solution has to be found! Collection and recycling is of course the ultimate goal, however to achieve this in the limits of an NGO like El Porvenir is unrealistic. Therefore, another way of improvement has to be thought of!

3.2.1 Sanitary Facilities: Analysis

Hand washing

To reduce infections and diseases hand washing is a very important factor. Therefore, the people in the communities were asked how often they wash their hands a day as well as in combination with which tasks they do so.

Gray Water and Trash

Lastly, I want to focus on two subjects not included in the interview structure, gray water and trash. Because there was no data collected during the survey to these subjects, this section is entirely based on personal observations, too.

In terms of gray water treatment, the situation in the communities might yet not be problematic. Nevertheless, will the pollution increase in the future, especially with the introduction of more aggressive cleaning materials, for example washing powders, downy or rinse aid. Thus, solutions have to be considered for the future. A functioning sewage system is for

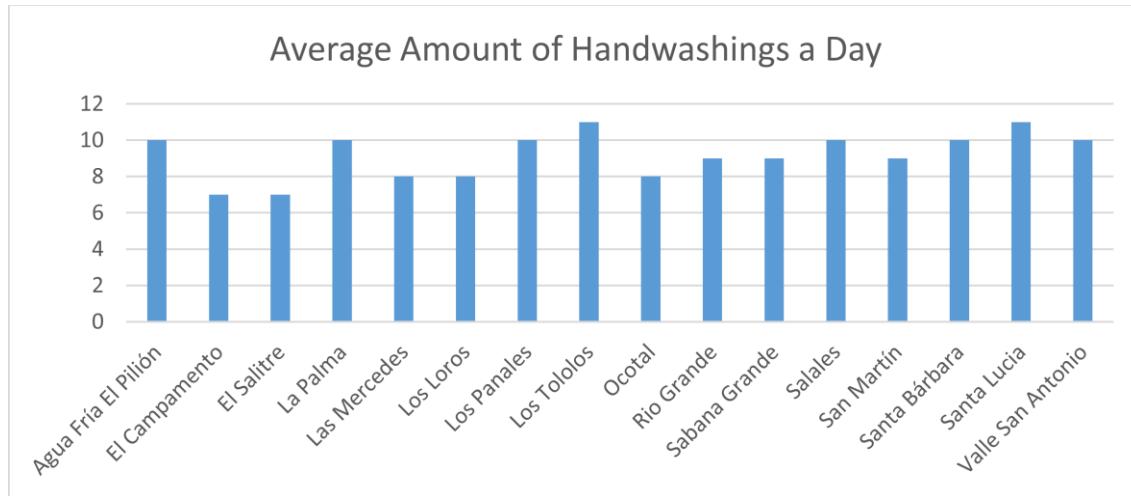


Figure 13: Average amount of times the people wash their hands in the respective comarcas.

The people explained that they wash their hands in average 8.9 times a day. Considering three meals a day and an assumption of five visits at the toilet, this is a fine amount of times. Also the distribution over the different comarcas, did not show a region with high deficits (Figure 14). Although, for this average some answers have been taken out of consideration. Of the 268 questioned 13 people stated that they washed their hands more than 25 times a day, some as high as 100 times. These amounts were not been taken into account, because they were obviously too high.

Toilets

The coverage of toilets in the municipality of el Sauce is quite good. Figure 13 shows the distribution of latrines in the different comarcas. Overall, the coverage is quite good. The comarcas el Campamento, el Salitre, Ocotal, San Martin and Santa Bárbara have a coverage of 100 percent, plus Las Mercedes were 9 percent of the people have a flush toilet. However, in the rest of the comarcas are still communities in which the people have no toilets available. These can cause pollution of drinking water and increase the

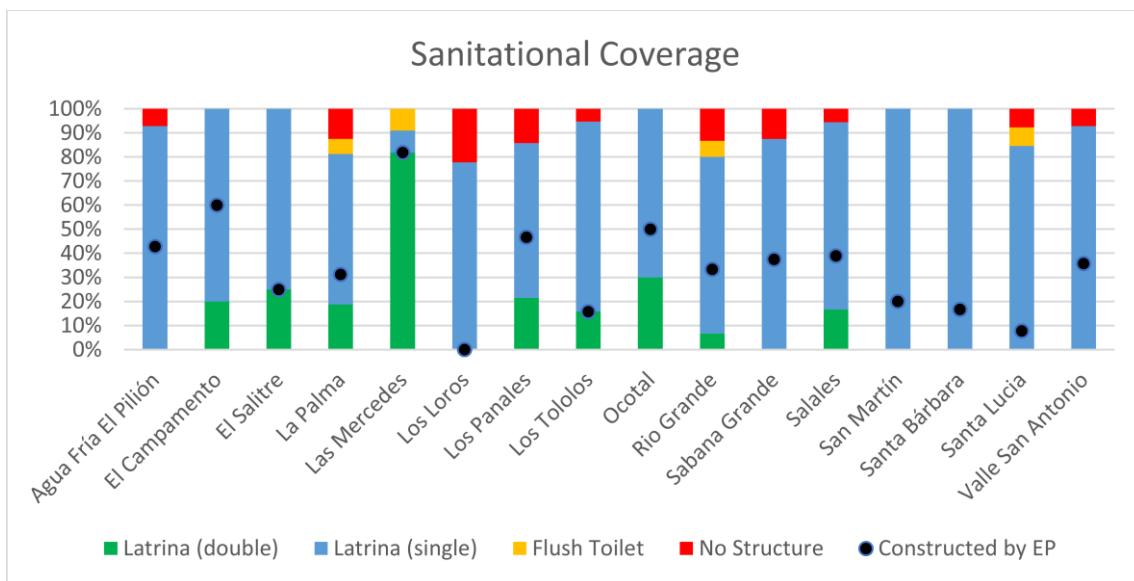


Figure 14: Types of toilets and percentage constructed by El Porvenir in the respective comarcas.

possibility for infections, e.g. transmitted by flies, which were in contact with the excrements.

Additionally was the amount of toilets constructed by El Porvenir measured. The presence of El Porvenir is very different in this regard. In Las Mercedes El Porvenir constructed 82 percent of the toilets, all of the double pit latrines. However, in Los Loros El Porvenir did not construct any latrines so far. Here live also 22 percent of the people without a latrine, therefore a big potential of improvement is possible.

Problems of El Porvenir Latrines

The biggest problem with latrines is when they are flooding in the rain season. This means, water excrements and disease-causing agents can migrate from the pit directly into the groundwater. This especially happens in the rain season when the flow rate and the groundwater table are higher. An indicator for this is when latrines fill with water. Figure 15 shows the percentage of flooded latrines in the different comarcas. As demonstrated have 21-57 percent of the people problems with flooded latrine pits in the winter, throughout all the comarcas. This is an immensely high amount! During flooding the following things can happen to pit latrines:

- Groundwater and drinking water pollution due to the groundwater level rise and wash in of human excrement and urine
- Pit latrine can collapse, if pit design is not adequate
- Pit can overflow due to excess water.

To determine how the projects of El Porvenir help the people in this regard, the data was analyzed, in order to find out how many of the latrines of El Porvenir have problems with flooding compared to others. However, the analysis shows that there is only a marginal advantage for the El Porvenir constructed latrines, 32 compared to 34 percent flood.

A possible solution would be to determine the groundwater table during the rainy season prior to the latrine construction. If the groundwater table is too high for a conventional setup, possible solutions might lie in the construction of sand enveloped latrines or raised pit latrines.

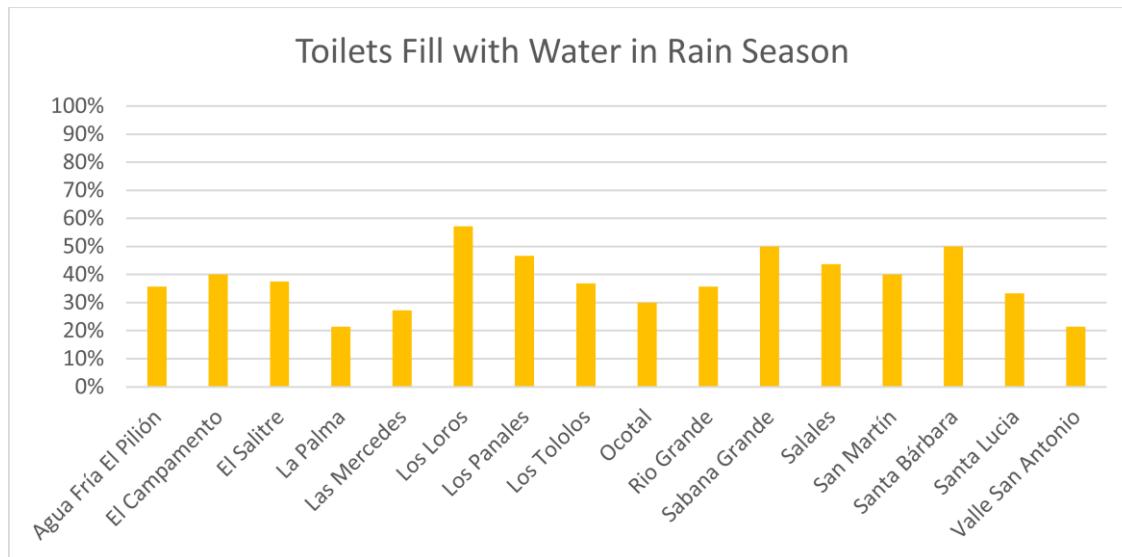


Figure 15: Percentage of flooding latrines in the rain season in the respective comarcas.

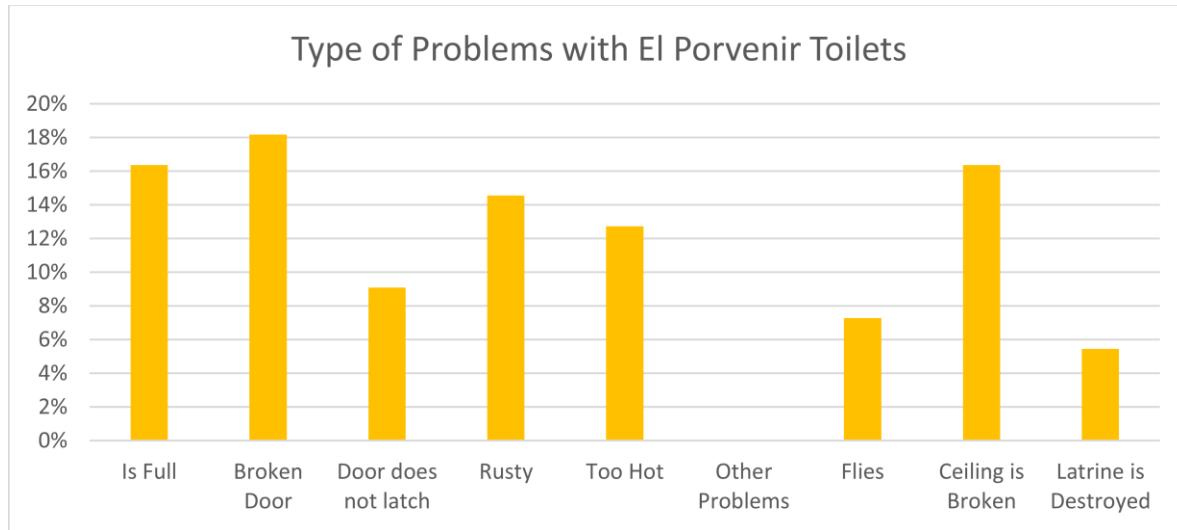


Figure 17: Occuring problems at El Porvenir toilets.

Furthermore, the interviewed were questioned about what kind of problems they have with their toilet. Figure 17 shows the percentage of El Porvenir latrines without problems in the different comarcas. It has to be recognized that in average the 64 percent of the interviewed told the team, they had no problems with their latrine. Nevertheless, the distribution of problems in the different comarcas is rather different. Four out of the 14 comarcas have no problems at all, but in Ocotal and Valle San Antonio only 20 percent of the latrines are without problems. Unfortunately it is unclear why this difference occurs. Thus, the overall problems of latrines constructed were analyzed. The findings are presented in Figure 16.

First, no one of the interviewed claimed to have “other problems” therefore the categories are quite fitting! Second, category “is full” are rather easy to solve problems, by the construction of double pit latrines, which are for most get constructed by El Porvenir lately. “Destroyed latrines” are considered of be damaged by unconventional events like storms, falling logs or vandalism (might the highest rate).

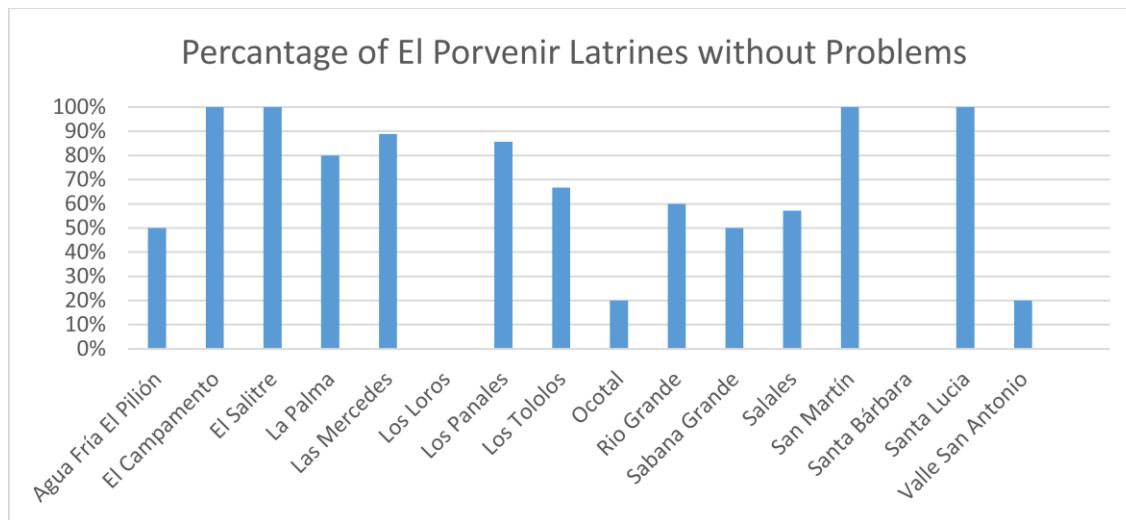


Figure 16: Percentage of El Porvenir latrines without problems in the respective comarcas.

Although, there is not enough data specifically to this problem. The latrines being “too hot” is a difficult to solve problem. The rest of the categories “broken door”, “door does not latch”, “rusty” and “broken ceiling” are considered to be problems caused by a lack of maintenance, mainly a lack of lubricating, rather than structural problems.

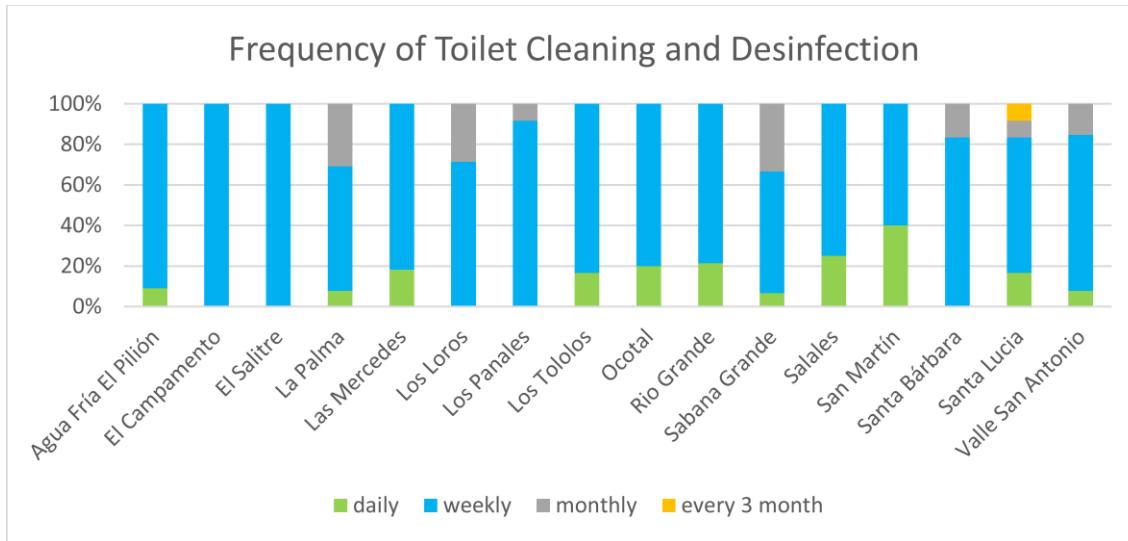


Figure 18: Frequency of toilets been cleand and desinfected.

Maintenance of Latrines

As stated in section Problems of El Porvenir Latrines a lack of maintenance, like lubricating, causing causes the structure to break down over time. However, cleaning the latrines and adding ash, clay, rice, etc. to improve composting is another important part of maintenance.

Figure 18 shows the frequency people clean and disinfect their toilets. In all of the comarcas, but Santa Lucia, people clean and disinfect their toilets at least once a month. In nine of the 16 comarcas 100 percent of the people clean and disinfect their latrines even weekly or daily. In Santa Lucia are eight percent of the people who only disinfect their toilets every three months. However, these are also the eight percent of the people who own flush toilets. Thus, this is not as bad as it would be for latrines. Overall, the rate of cleaning and disinfection is satisfying throughout the comarcas.

Unfortunately are the results for adding material to the latrines not as good as for cleaning purposes. As shown in Figure 19 the majority of the households (58%) add material daily to weekly. The best results were found in Los Loros with 86 percent adding material at least weekly. Once more the distribution varies quite a bit from one comarca to the other. Ocotál has once again the worst results, with only 30 percent of the interviewed adding substances weekly. This might be caused by a lower educational presence there. Furthermore, have seven out of the 16 comarcas households which do not add any material at all.

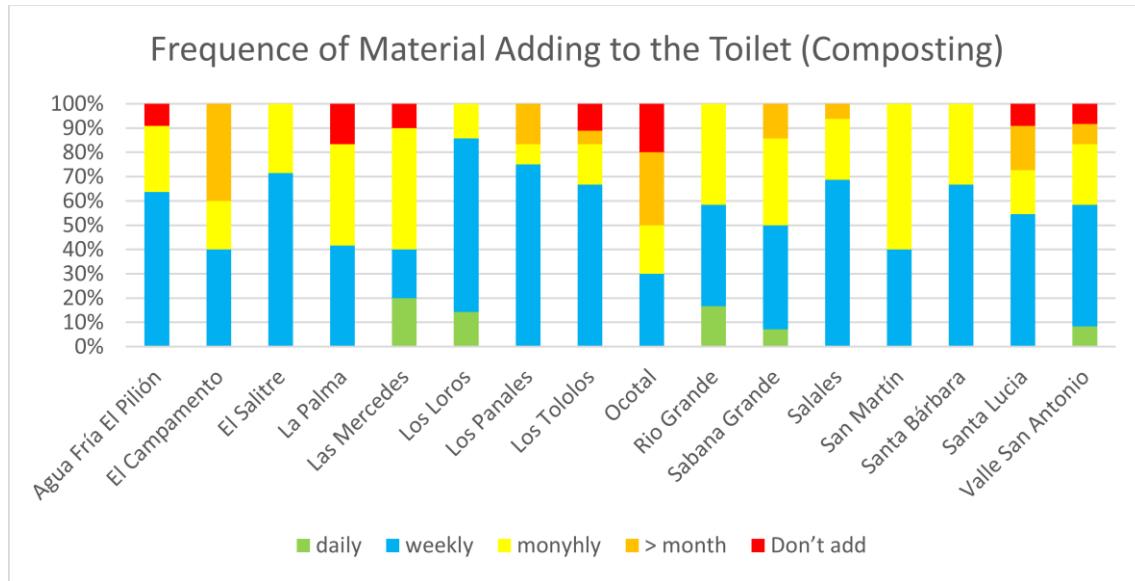


Figure 19: Frequency of material adding to improve compstation.

Laundry- and Washing-Stations

Six out of the 16 comarcas have no communitarian laundry- and washing-stations at all (Figure 20). Of the once that have any at all, Valle San Antonio is the only one that has an acceptable coverage. Here 86 percent of the people have excess to communitarian laundry- and washing-stations. In Agua Fria El Pilon, El Campamento, Las Mercedes and Rio Grande is the coverage as low as 20 percent or lower.

Furthermore, it was analyzed how many of the communitarian laundry- and washing-stations were built by El Porvenir. In Agua Fria El Pilon, El Campamento, Las Mercedes and Los Panales, all of the constructed by El Porvenir. Additionally were in Salales 71 percent, Santa Lucia 50 percent, Rio Grande 33 percent and as little as Los Tololos 13 percent built by El Porvenir. Of these constructed communitarian laundry- and washing-stations (by El Porvenir) 48 percent of the people use the facilities all the time. Of those 48 percent, stated 17 percent that the stations are too far away or too crowded.

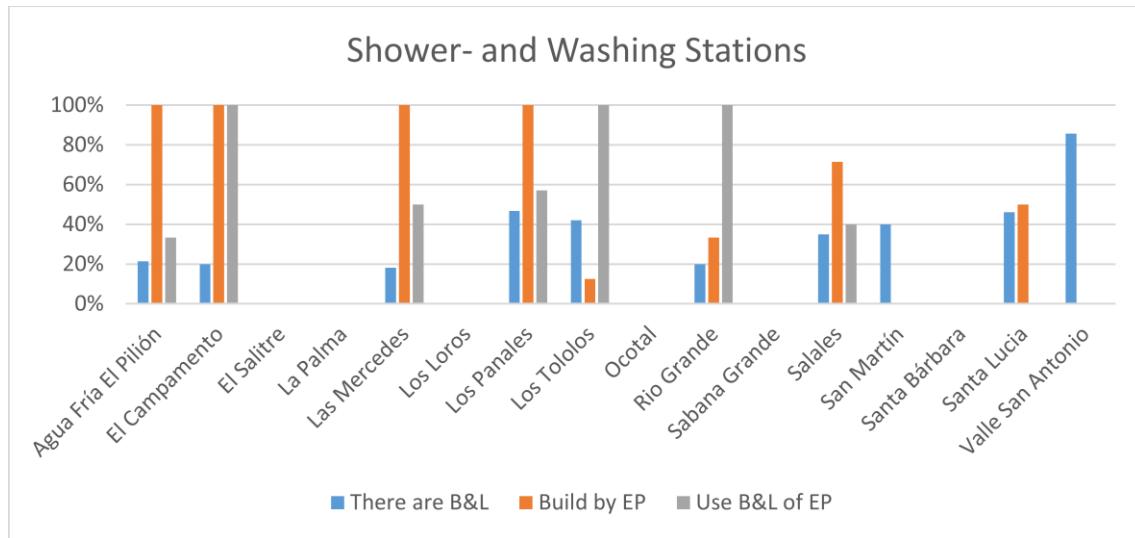


Figure 20: Coverage of washing and shower stations in the respective comarcas.

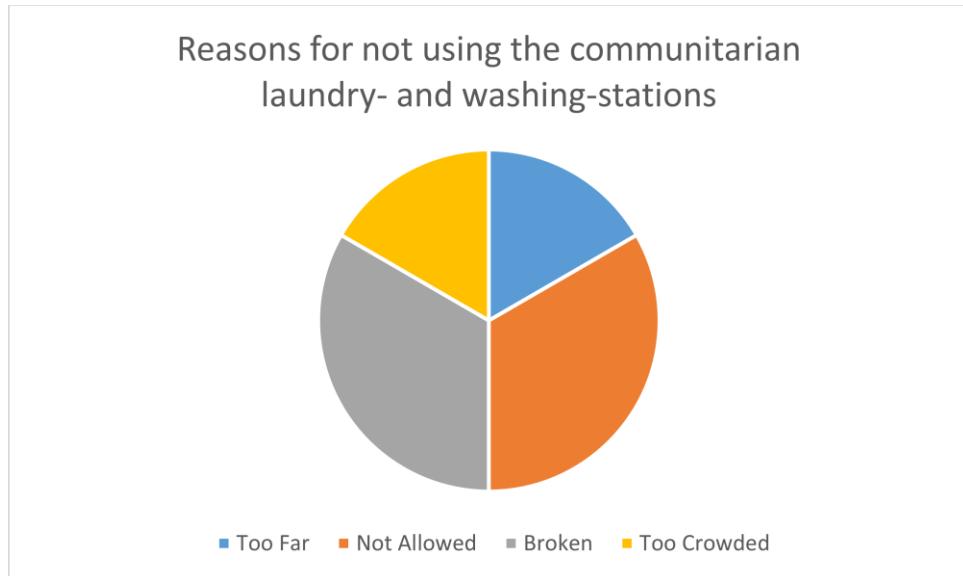


Figure 22: Reasons why citizens do not use public laundry- and washing stations.

For 33 percent of the people do not use the stations because they are either broken or they are not allowed to (Figure 22).

Consequently, the question rises where do the people do their washing? As displayed in Figure 21 do the majority of the interviewed household their washing either way at home or at the River. In Sabana Grande and Santa Lucia some of the interviewed do their washing even at local springs. Thus, the question raises, what happens to the gray water? Unfortunately this question was not raised in the interviews at all, but is a rather important one that should be investigated in future studies.

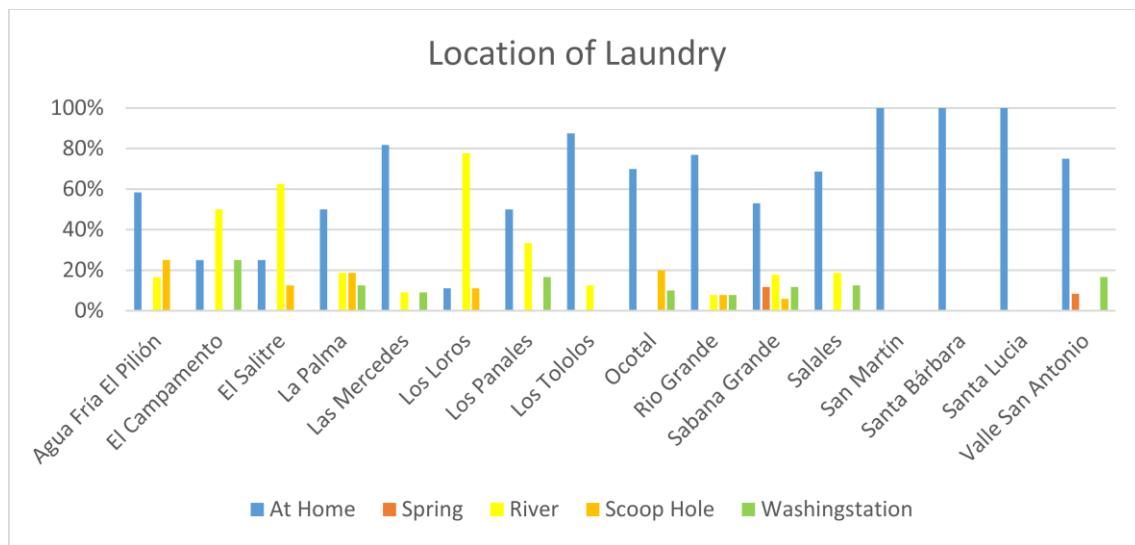


Figure 21: Locations where the citizens of the respective comarcas do their laundry.

Stomach Problems and Diarrhea

A good indicator of the sanitary situation, freshwater condition and personal hygiene is the frequency people get stomach problems or diarrhea. Thus, the interviewed were asked when one of their family members experienced those problems the last time. Figure 23 shows the findings to this question. First it has to be stated, that (accept for Santa Bárbara and Los Tololos) people usually have either very recently, within the last month, or very scars problems in this regard. Over all about 40 percent of the interviewed stated that there were recent problems within the family (less than two weeks). For all those negative interviews were three proxies analyzed:

1. Was the water source tested for contamination (Water Quality)?
2. Was a freshwater treatment performed (Freshwater Treatment)?
3. Does the family use a scooping device to pour water of their drinking water container (Storage of Drinking Water)?

In total 72 percent of the interviewed stated that their water source was either contaminated or not tasted. Another 41 percent did not use any form of freshwater treatment and 63 percent scooped their water with a scooping device from their drinking water container. It is most likely that a combination of those problems caused the issues.

However, the problem seems to be more punctual in certain communities rather than be symptomatic for the whole comarca! Nevertheless, shows the overall high percentages of untested or contaminated water, use of a scooping device and not performed freshwater treatment that there is a lot room for improvement in general.

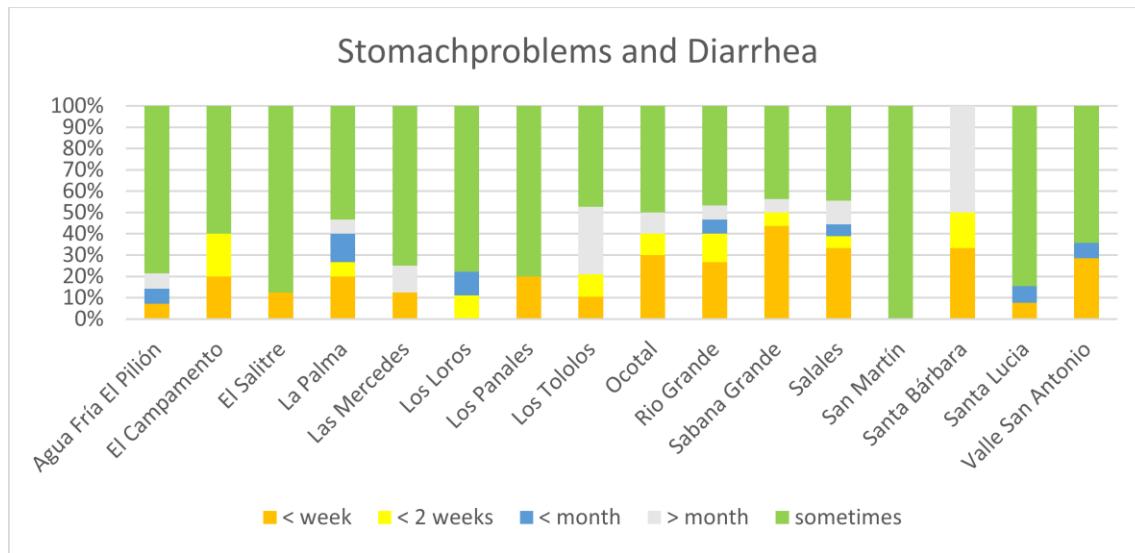


Figure 23: Percentage of the citizens having stomach problems or diarrhea in different time intervals, splitted in respective comarcas.

3.2.2 Sanitary Facilities: Recommendations

The by far biggest problem of the sanitary facilities is the high percentage of filling latrines in the rainy season! Furthermore, the latrines constructed by El Porvenir seem to be no better than the ones the people construct themselves in the communities, in this regard. Therefore, I recommend doing more research before the construction. This has the highest priority! Possible solutions may be in the use of the concepts of Sand enveloped latrines or/and Raised pit latrines.

Furthermore, people should get additional supervision about the maintenance of their latrines. If possible with additional support by communitarian educators.



Figure 24: Displays problems with gray waters entering the soil without filtration.

At last, I want to introduce a different topic which was not attended in this report: gray water. Figure 24 shows a washing station after a few years of service. As you can see, there is a major problem with the appearing gray water, which occur often right next to the wells. Furthermore, the gray waters of the households (specially kitchen) or from bathing usually go unfiltered into the ground. At the moment this might be a minor issue, but at a certain quantity it will become a real problem. With growing population, introduction of washing machines and more aggressive cleaning materials, the breaking point will definitely come. Thus, solutions have to be considered for the future and get implemented into the working procedure of El Porvenir.

3.3.1 Education: Analysis

Presence of El Porvenir

The work of the team of El Porvenir in el Sauce is highly based on educational issues. The educators and promoters advice the people about personal hygiene, freshwater treatment, maintenance of water systems, etc. as well as possible projects, like reforestation.

For the analysis two proxy questions were asked:

1. Do you remember an educator or promoter of El Porvenir, who visited your house or community?
2. When was the last time a member of El Porvenir visited your house or community?

Of cause, the second question relies on a positive answer of the first one. Thus, Figure 25 shows both data sets in relation to each other. The black dots show the amount of people remembering a promoter or educator of El Porvenir.

Once more El Campamento is the comarca with the best coverage. On the contrary, show Santa Bárbara, El Salitre and Los Loros a very low presence of workers from El Porvenir. This leads to the conclusion that the presence of El Porvenir in the communities has a strong positive effect!

The second part of Figure 25 shows when the last time a member of El Porvenir was present at the community. Here is a very different trend visible in the different comarcas, highly depending on current ongoing projects in different communities. The best result shows Las Mercedes, where 70 percent of the interviewed have met a member of El Porvenir within the last month. The arguable worst result was in San Martín, where 76 percent of the people told the team that it had been over a year since the last time a member of El Porvenir visited their community. The overall quite high rate of long absence of El Porvenir members in the communities is most likely caused by the size of el Sauce in combination with quite bad roads. For the research team of this study, it took one month to visit all the comarcas with a team size of four to seven people at a time. Additionally, the team stayed only very briefly in the different communities for the interviews. Therefore, the long absence of El Porvenir in a lot of the communities is considered to be quite normal result. Furthermore, the citizens remember the staff of El Porvenir in a very positive way. For example in most of the cases, they were even able to recall the name of the staff member they worked with.

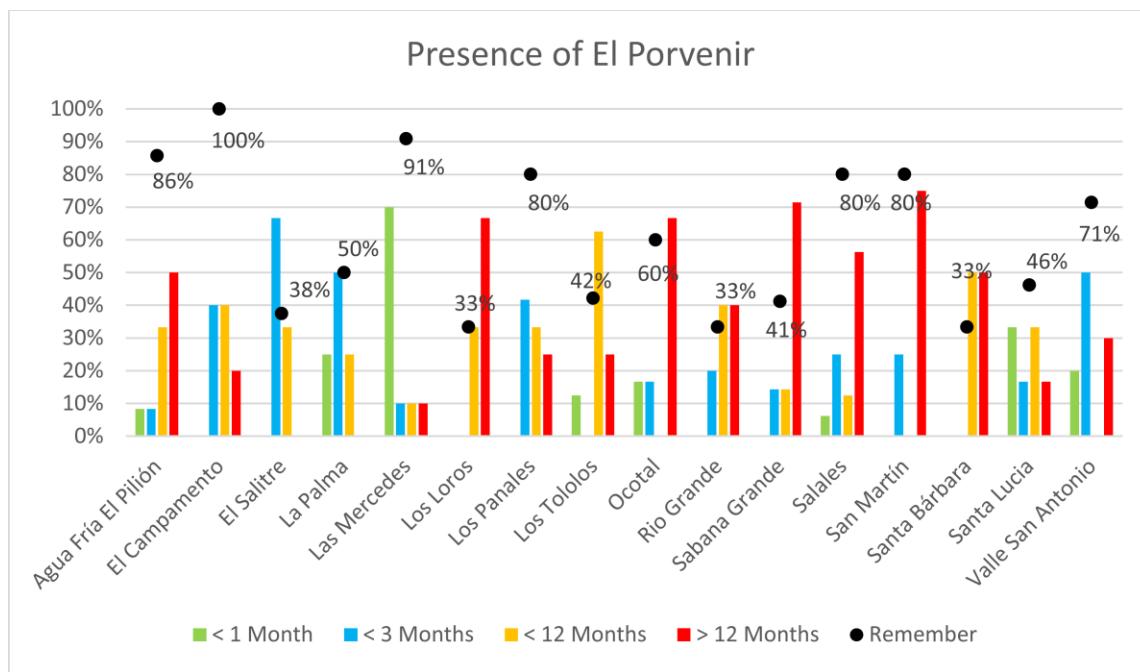


Figure 25: Percentage of citizens remembering staff of El Porvenir visiting their house or community: and the last time of their visit.

Communitarian Educator

Communitarian educators are very important, as they function as multipliers for El Porvenir. Therefore, the interviewed were asked two questions about this topic:

1. Is there a communitarian educator in your community, who educates you about personal hygiene, freshwater treatment, maintenance of water systems, etc.?
2. Did this educator visit your house in the last year?

Of cause, the second question relies on a positive answer of the first one. Thus, Figure 26 shows primarily the coverage of the existence of communitarian educators, which is at 39 percent in average over all comarcas. In Las Mercedes the all people (100%) stated that they have a communitarian educator in their community. The lowest coverage is at Sabana Grande where only 6 percent of the people have a communitarian educator at their side.

Despite this low average rate of active educators, the presence of the active communitarian educators show in their communities appears to be phenomenal. In 8 out of the 16 comarcas, 100 percent of the people told the team that they were visited by the educator within the last year. Overall, the average rate was at 81 percent for all el Sauce. This exceeds the presence of the team of El Porvenir by far. However, this is not to take as a negative statement on the team of el Sauce! Due to the much higher quantity of local educators, shorter distances, smaller areas to cover and them living at the communities, the communitarian educators have a tremendous advantage.

Therefore, it has to be considered if it is possible to recruit more communitarian educators and primarily educate them to train their fellow citizens, to maximize the people frequently reached by El Porvenir.

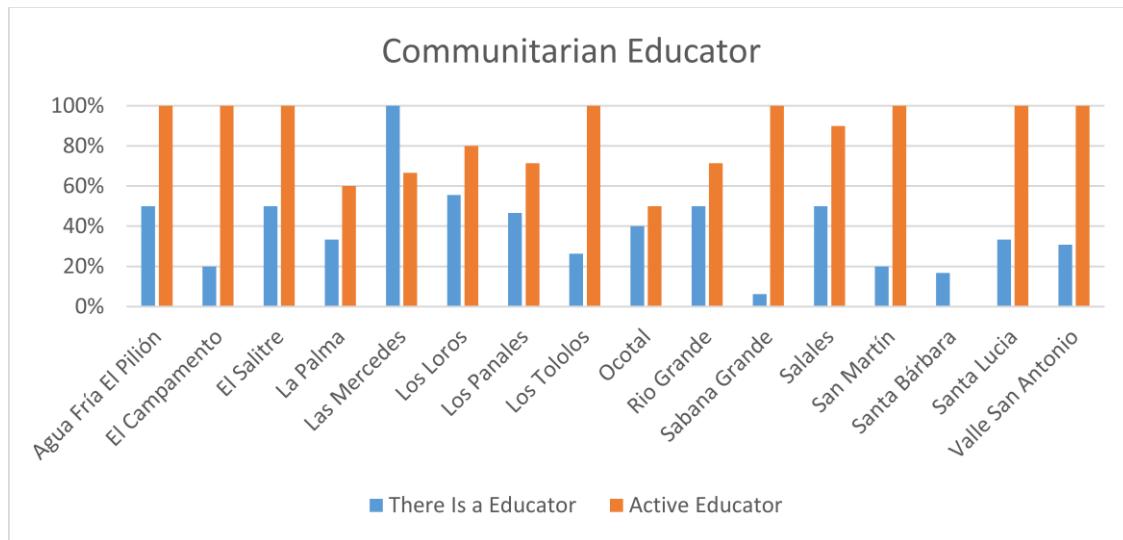


Figure 26: Percentage of communitarian educators in respective comarcas. Additionally it is shown the percentage of those who are active.

Radio Show

El Porenir tries to reach all the communities at the same time by using a weekly radio show. In el Sauce however, this attempt failed so far. Figure 27 shows the devastating outcome of the study in this regard. Except for Santa Bárbara, where 50 percent of the people claim to listen to the program sometimes, usually more than 70 percent of the people do not listen or never heard of the program at all. In six of the 16 comarcas even 100 percent of the people do not listen to the program.

Only in La Palma (19%), Los Tololos (5%) and Salales (6%) people sated that they are listening to the program every week. In the town of el Sauce only 2 percent of the people listen to it, even though there is a guaranteed availability of the radio signal and rather a lot of people do possess a radio.

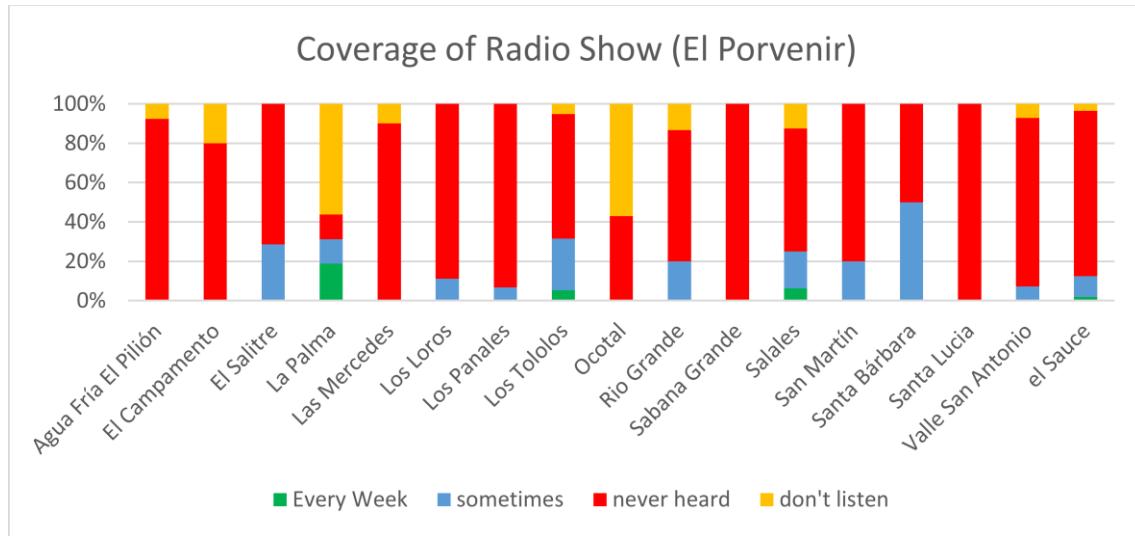


Figure 27: Citizens not knowing or the frequency are listening to the El Porvenir radio show in respective comarcas.

Overall, the average rate of people listening to the show weekly is as low as two percent and 85 percent did never hear about the program or do not listen to it. Therefore, the effectiveness of the program is very questionable!

3.3.2 Education: Recommendations

The impact of El Porvenir in the communities is clearly visible and the general presence good. However, el Salitre and Santa Bárbara clearly need more attention from the local office.

Local, communitarian educators show to be very effective to help the El Porvenir's goals in the communities. Therefore, I recommend to extent the efforts to recruiting new local communitarian educators.

The radio show fails its propos by far. Therefore, I recommend either reworking the concept of the show or redirecting the resources to another field. Although it is questionable if a rework will have a positive impact.

Another recommendation on my behalf, which is based on my observation in the field, is to explain the people how they can get help by El Porvenir. I generally asked: "do you have questions?" at the end of the interview and if they had questions, it was always how to get help or how to apply for it. This recommendation might be difficult to combine with the working strategy of El Porvenir, but I feel like the people should know how to apply for help if they need to.

3.4.1 Reforestation: Analysis

In the municipality of el Sauce reforestation projects are rather scars. Overall only 30 percent of the interviewed explained that they had a project in their community. The only major projects are located in Auga Fria El Pilion, Las Mercedes, Ocotal and Salales. Although, for the whole scale of the comarca only Las Mercedes (82%) and Ocotal (80%) have a good coverage. Los Loros and San Martin do not have any projects at all.

Of this rather low amount of projects are 61 percent indicated by El Porvenir. In six of the 14 comarcas with reforestation projects, all of the projects are led by El Porvenir.

Additionally, the interviewed were asked about size and location in perspective of the water catchment. Unfortunately, the interviewed were mostly not able to answer these questions to a satisfying extent.

3.4.2 Reforestation: Recommendations

Although El Porvenir already is the main initiator of reforestation projects in el Sauce, further efforts are needed to ensure a sustainable environmental base for the future! Especially considering its crucial role for water quality and quantity!

Cooperation's with local officials might be beneficial. Especially because many of the schools requested reforestation projects to provide shade at their properties.

Due to the difficulties of the interviewed to answer the questions, I recommend for future studies to additionally interview the local promoter for reforestation from El Porvenir. They may provide more detailed and exact information about the situation and projects.

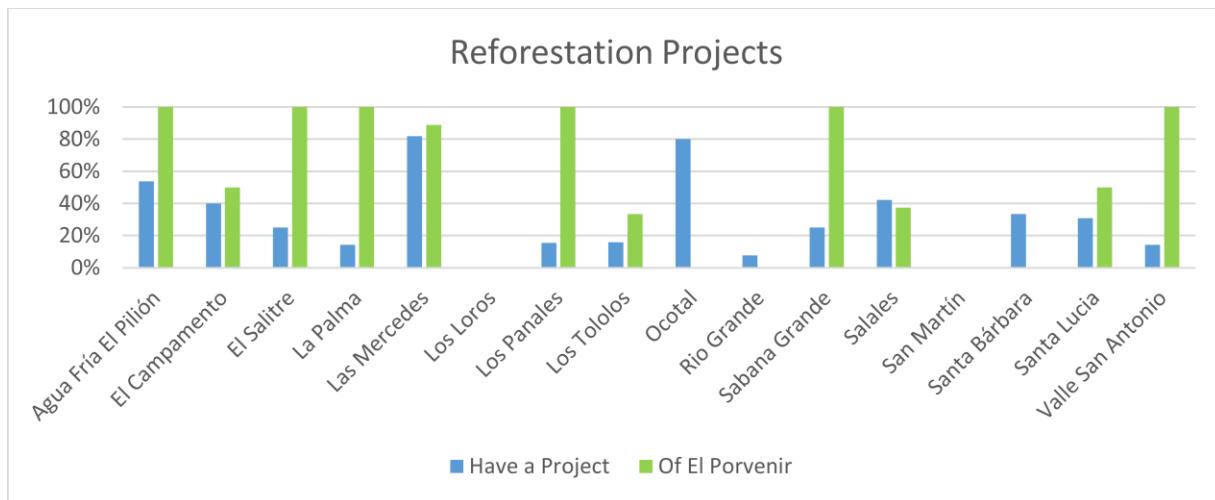


Figure 28: Percentage of reforestation projects located in respective comarcas, and the percentage introduced by El Porvenir.

3.5.1 Household Situation: Analysis

Stoves and Respiratory Problems

Throughout the municipality of el Sauce respiratory problems are a common problem. Due to two major problems; first, the strong aridity leads to a high amount of dust in the air. Second, smoke produced from both from burning trash and cooking with wood. As shown in Figure 29, except for el Salitre and San Martin, in every comarca citizens were suffering respiratory problems as direct cause of smoke of their kitchen. Thus, an average of 31 percent of the people suffered knowingly from problems related to smoke. For an overall percentage this is arguable, because 72 percent of the interviewed were women and therefore mostly working in the kitchen or close to it in the household. However, the actual amount might be a lot higher, especially considering long-term issues with smoke inhalation, e.g. cancer. Taking into account this percentage, in the rural areas of el Sauce more than 6000 people suffer of directly related problems caused from smoke inhalation.

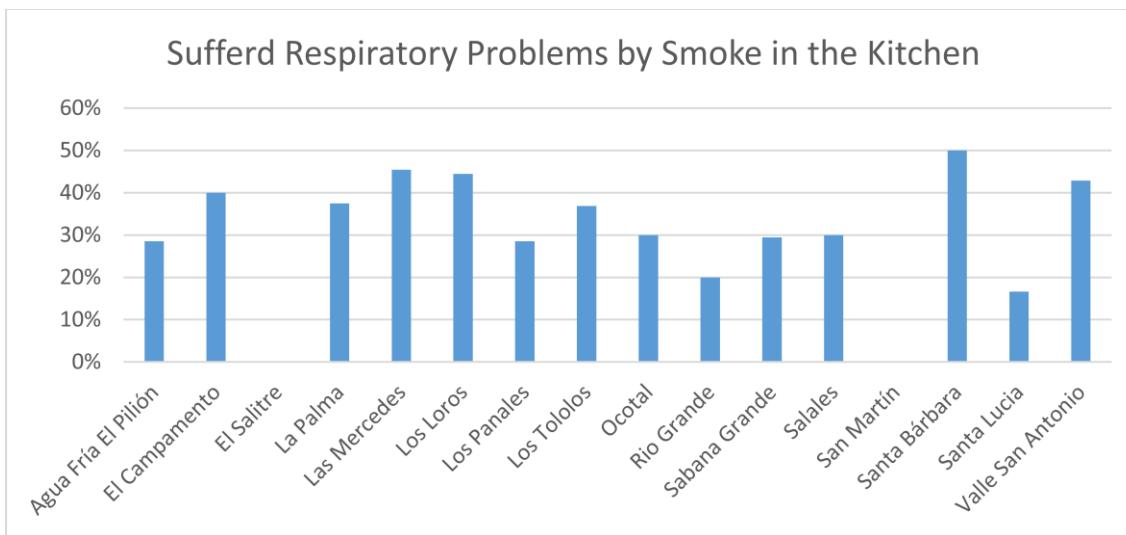


Figure 29: Percentage of citizens who suffered respiratory diseases as cause of smoke pollution in their kitchen, splitted in respective comarcas.

On order to improve this issue, the installation of chimneys can help a great deal. However, as shown in Figure 30 the coverage of those, so called improved stoves, is very low. The best coverage was found in Las Mercedes and San Martín, where 40 percent of the people have improved stoves, both 20 percent in good and 20 percent in bad conditions. In Los Loros, Santa Barbara and Valle San Antonio none of the interviewed had an improved stove. Overall 12 percent of the citizens were in possession of an improved stove. Of those, El Porvenir constructed 67 percent. Additionally, although not quantified, were a few gas-using stoves accounted as improved stoves. Therefore, the percentage of El Porvenir constructed stoves might be even higher. Thus, El Porvenir can be considered to be the, more or less, only reliable source for construction of improved stoves in the municipality of el Sauce.

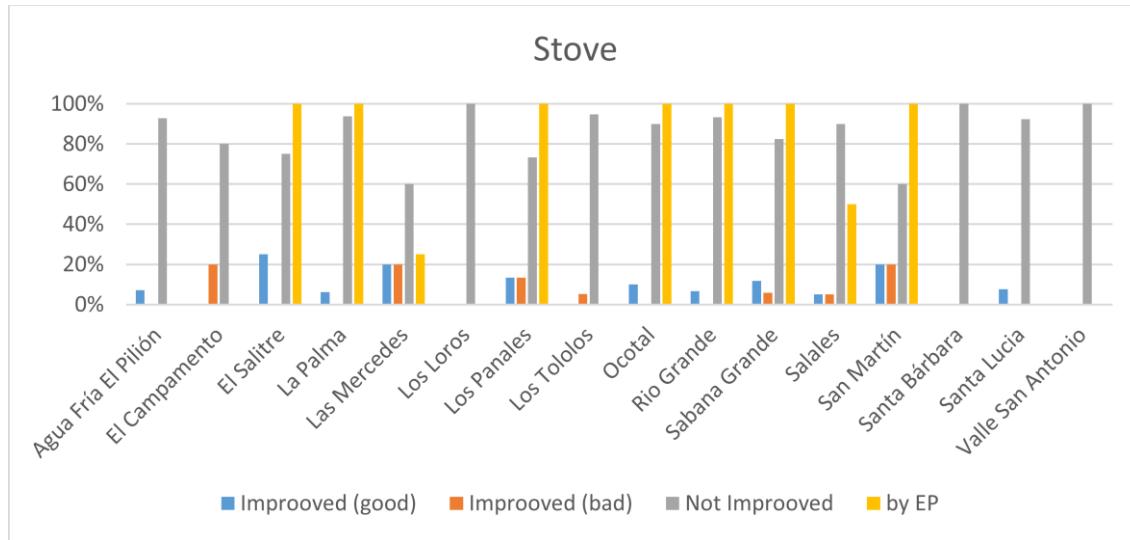


Figure 30: Percentage of households with not improved soves and improved (good or bad condition) stoves, as well as their percentage constructed by El Porvenir, in respective comarcas.

Household Situation

To determine how advanced the gender equality is in the communities of el Sauce, the interviewed were asked: who administers the money, who attends at communitarian meetings and who takes the important decisions. All three categories were only asked in households with male adults.

The findings are presented in Figure 31. For the questions; who administers the money and takes the important decisions for the family, the majority of households share the task equally, followed by man. For the attending of communitarian meetings woman were present the majority of times. Most likely due to the fact, that the contribution of tasks are still distributed traditionally (woman at home, man in the fields). This is also represented in the distribution of the task of bringing water from the water source to the house (Figure 32).

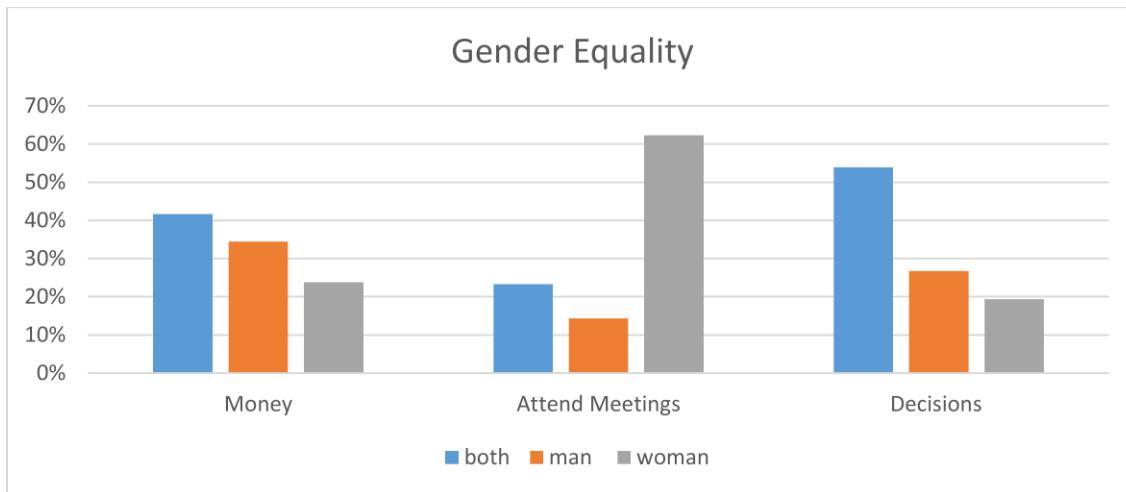


Figure 31: Gender equality proxies at the household; who administers the money, who attends communitarian meetings and who takes important decisions.

Furthermore, the percentage of children going to school was determined at 98 percent. The only four interviewed, who stated that their children did not go to school, claimed as reason that:

- Their child is disabled and there is no appropriate facility.
- They do not have enough money to send their children to school. Although education is free in Nicaragua.
- The parents do not want to send their children or kids do not want to attend school (two interviewed).

At last, the interviewed were asked whose live quality did get improved the most by El Porvenir projects. As Figure 33, have the lives of the male population only improved the most in one percent of the cases. In the cases that the lives of the women were improved the most, the foremost reason was that they had to carry less often or less far water to the house. In the case of the most improvement for the live of the children was that they especially do get sick less often. For 90 percent of the interviewed the change was equal for all people because their lives got easier, healthier and in general simpler.

Requested Projects

In the communities where El Porvenir was already present, the citizens were asked to state what kind of project (water quality, water quantity, sanitation, education and reforestation) they still need in their community. The gathered data is very diverse and therefore was not generalized. However, the individual interviews could be used in the future to have a brief overview where to promote what kind of project.

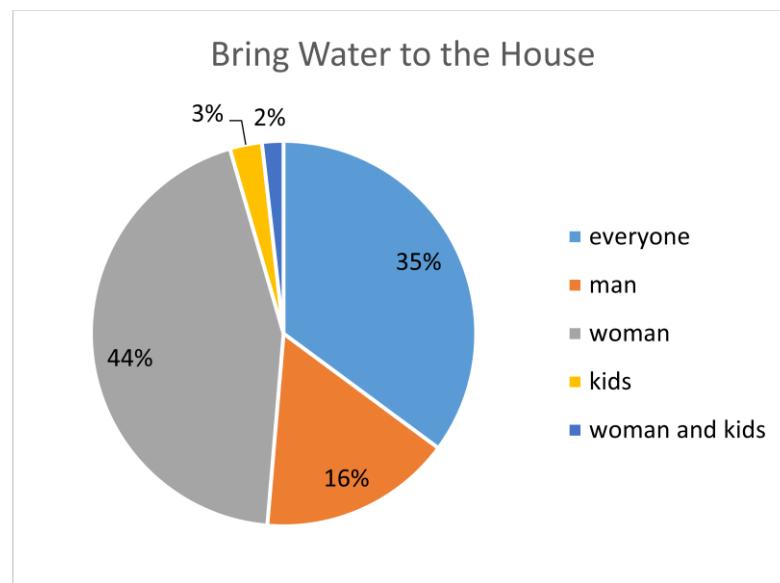


Figure 33: Percentage of family members who are responsible for the delivery of

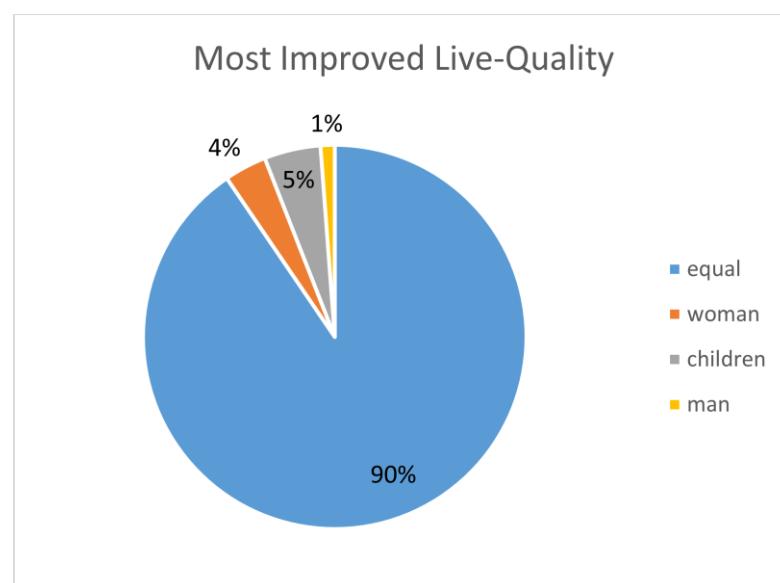


Figure 32: Whoes lives got improved the most by the projects of El Porvenir.

3.5.2 Household Situation: Recommendations

The most pressing issue in this section of the analysis is the extreme high rate of respiratory problems throughout the comarcas. In combination with the fact, that no other organization than El Porvenir provides help on this regard is even more concerning. The construction of a chimney is a rather simple and cheap procedure and therefore can be constructed by the people themselves, with some supervision. It might even be possible to be supervised by a communitarian educator, rather than having the need for an El Porvenir staff member.

The general gender equality is quite good, but can be further improved. Although in a predominantly agricultural society it seems to be rather difficult to achieve significant results, due to strongly divided gender tasks. Also, I feel like in many of the communities occur more pressing and augend issues to focus on. However, an improvement in this regard has to be encouraged.

In terms of requested projects, I strongly advice to change this question to be asked in all communities, not just in the ones where El Porvenir is already present! However, for the specific communities additional focus can be taken on an overlap of existing projects and requested once in the same field

3.6.1 Public Institutions: Analysis

In this section are the interviews and the collected data of public institutions in the municipality of el Sauce is discussed.

During the interviews and the analysis, it became clear, that the interview structure is not fit for most of the public institutions but schools. It is not fitting for public institutions like administration offices in the town of el Sauce, NGOs, clinics and only partly for churches. Furthermore, there are only governmental institutions and NGOs found in the town of el Sauce where even the very well-structured Casa interview has its flaws. Additionally, there were only four interviews of clinics performed at all, a statistical analysis is therefore not appropriate. Thus, this section is primarily about the situations in the schools. Nevertheless, the quantity of this dataset (schools) is for the most parts of the interview very scars, due to an error in the logic of the interviews.

Water Access at Public Institutions

Figure 34 shows the amount of public institutions with access to water at their property, 61 percent of the schools and 48 percent of the churches responded positively to this question.

The high amount of schools having a wells, is related to the high amount of schools constructed by Vison Mundial, which most of the times also constructed a well. However, many of those are not in working conditions!

With about half the churches having water at their property, of those are about two-thirds communitarian. Thus, the coverage is quite good. Especially considering that the quantity of actual services in the churches is in most of the communities rather low. Therefore, a construction of a well seems often no very efficient.

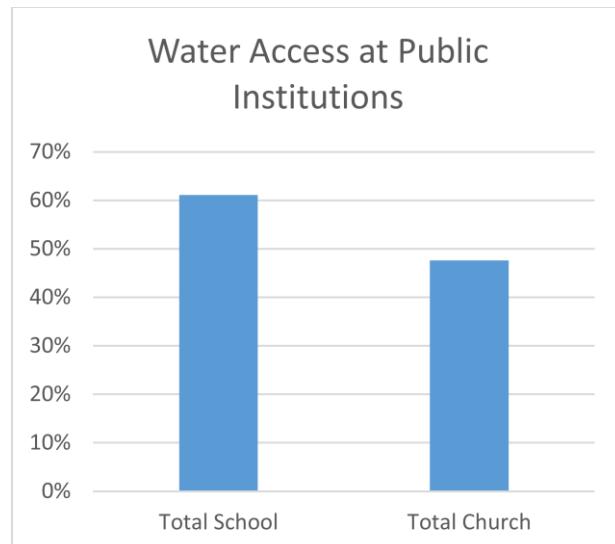


Figure 34: Percentage of public institutions with water excess.

Hygiene in Schools

Hand washing stations in schools with soap were only found in 50 percent of the visited schools. However, 96 percent of the teacher claimed to train the kids in hand washing. Therefore the question has to be raised how they train the kids in these schools? Furthermore, it was stated from 28 percent that the kids get schooled by their parents and 11 percent by communitarian educators. Additionally, both two percent by nuns and others (Figure 35).

Thus, the schools can be seen as the major places where children learn how to do proper personal hygiene. Therefore, hand washing stations should be located at all institutions.

However, the very high percentage of teachers training the children can also be related to the fact, that the team questioned mainly teachers about the subject.

Drinking Water Storage

Equal to questioner Casa, the teachers were asked about drinking water storage. The situation is displayed in Figure 36. As you can see, 92 percent of the schools have a special container, with a lid, which they frequently clean. Of those do not use 73 percent a scooping device that is 44 percent higher rate than in the households. This is especially good, as the schools do function as a role model for the kids and therefore the later home owner. Thus, this could have a beneficial long term effect.

The cleaning frequency is very positive, too. In total clean 63 percent of the schools their drinking water container daily, 35 percent weekly and only 2 percent monthly. Their cleaning method though, is rather unsatisfying, 27 percent of the interviewed stated that they only wash the containers with water, 58 with water and soap and only 15 percent with water and chlorine.

Projects Requested in Schools

Lastly the teachers were asked for projects they need in their schools. Figure 37 shows the percentage of projects requested in the cools. The lowest requested projects were for water quality, the highest for Latrines 54 percent. All of the 50 questioned schools requested at least one project. Therefore, it can be stated that a general improvement of school supportive projects are needed.

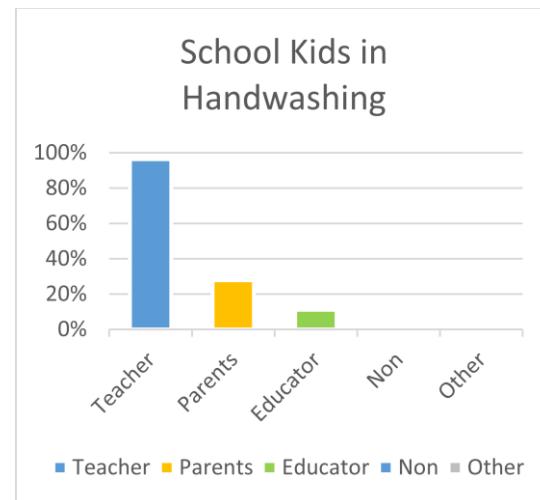


Figure 35: Persons who train the children in washing their hands.

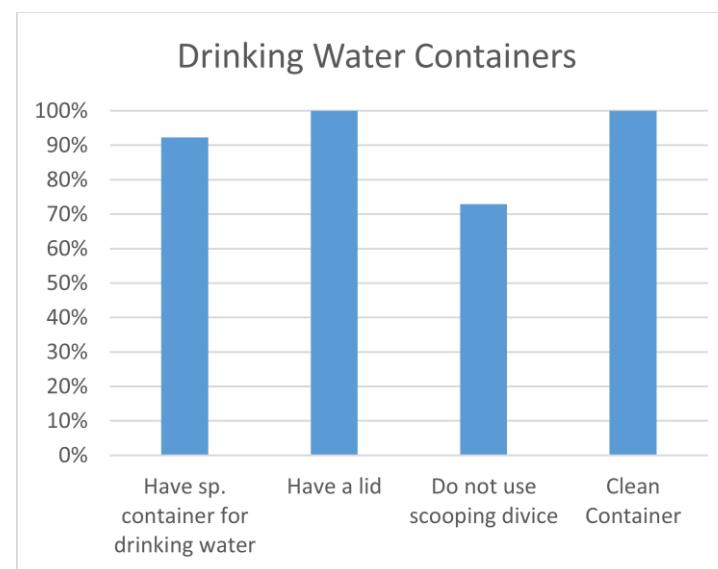


Figure 36: percentage of usage of specail containers, lids, scooping devices and cleaning of those devices.

3.6.2 Public Institutions: Recommendations

Due to the general low data output of this questioner are the main recommendations of the structural nature of the survey, and are therefore discussed in section 3.7 Future Survey: Recommendations.

In general, I want to recommend higher efforts to work at the schools, especially with educational efforts. Also on an infrastructural point of view, children are the easiest to educate and therefore to improve social changes in the future, e.g. in regards of trash management. Thus, an educational effort in the way of teaching the teenagers about the different aspects of rural water management could help them to recognize problems occurring in their communities and help them to solve those independently.

All the teachers requested at least one project during the interviews to improve their situation in the school. My personal observation was that most of the teachers have very specific and good suggestions for projects at their schools. Therefore, I recommend getting in contact with the local teachers to help them to find solutions for their issues.

3.7 Future Survey: Recommendations

This section was implemented to avoid errors, to maximize data output and consequently improve the analysis of future analysis of this kind. I recommend to change open questions into multiple-choice for questions about amount, size, distance, etc.. However, detailed question like: "Why do you not use the washing stations?"; "Why is the toilet broken?", should be included and open. This opens up the opportunity for a better understanding of problems.

To minimize errors set a minimum amount of minimum interviews in communities. I suggest at least three (maybe five) interviews in each community. Therefore, you can identify a definitive trend. Furthermore, the biggest consumer of time during the interviews is the distances to travel and the time the interviewer wait for the rest of the team. Thus, additional interviews will not prolong the total amount of time needed for much. On the contrary, do big communities not need seven or in some barrios up to eleven interviews to show reliable results. Especially, because bigger communities generally are better developed anyway. Additionally, limit the majority of interviews to rural or semirural areas!

The summary of comarcas leads to wrong assumptions about the communities. Strong differences within the comarcas appeared often. Therefore, the analysis of the regions especially for structural problems and detailed analysis has high errors for the current way of analyzing. Thus, I recommend:

1. Sum up all the interviews and generalize the data, to obtain an average state within the municipality.
2. Compare the generated status quo to specific communities in order to find general problems and good working processes.

Additionally, this approach would simplify and improve the meaningfulness of these reports.

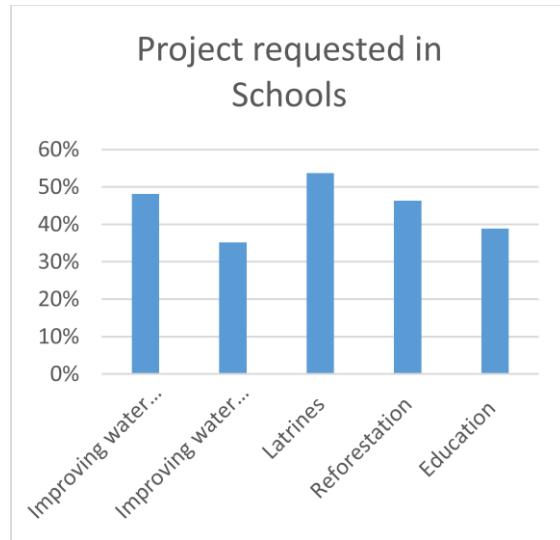


Figure 37: Requested projects of teachers for the schools.

The state of the public institution questionnaire is arguable only suited well for schools. Therefore, I recommend changing the questioner to be specifically designed for schools, to benefit the analysis. Schools are the institutions with by far have highest attendance of people in the rural areas. Also changes in the cultural structure (e.g. treatment of trash) are likely to be implemented on a long time scale. Therefore, I recommend improving those interviews and applying them to all the schools, not just to them which already have projects of El Porvenir, as currently performed.

Furthermore, show the results for the churches questioned not much of a data gain. I do understand that the church community plays an important role within the communities. However, I feel like the benefits of the interviews in the current state are very limited. The same applies to clinics and other public institutions. The pastors and nurses appeared to have a good overview on the situation in the communities. Thus, it might be beneficial to do an open interview with the pastor or medical stuff, e.g. as a focus group with other community members, possibly in communities where mayor problems have been found.

For the next survey, it might be beneficial if the volunteer in charge performs the interviews for one week in a municipality and works through two region El Porvenir is interested in ,e.g. for sauce: el Campamento and Santa Barbara (good and bad setting). After this it would be beneficial to rewrite the survey with specific goals in mind (!) what the office of the region and Managua wants to know! Therefore, the creator will know the flaws of the interviews and will be able to fix them. This is especially important, because hotfixes during the interviews are not possible with Magpi, without altering the database completely!

Chapter 4: General Recommendations

This chapter highlights the most important findings of this survey, more specific information can be found in the individual sections of chapter 3. General recommendations are:

- Increase the amount of water testing at the water systems. Two probes a year one each in the dry – and rain season, to insure water quality and to find solutions for pollutions (Water Quality).
- Improve existing water systems in water quality and quantity. Identify issues of water systems constructed by El Porvenir and try to fix those, rather than constructing new once (Construction of Wells).
- Promote filter systems, to improve freshwater treatment and to limit the use of scooping devices (Freshwater Treatment).
- Encourage formation and education of CPAS, to benefit water quality and possibly quantity at local water systems. Make a formation of a CAPS mandatory for the construction of water systems from El Porvenir, prior to the construction (Comite Agua Potable y Saneamiento (CAPS))
- Implement strategies to improve gray water and trash related issues (Gray Water and Trash).
- Improve El Porvenir constructed latrines for rainy season (Problems of El Porvenir Latrines).
- Increase efforts to recruit and train communitarian educators (Communitarian Educator).
- Redirect resources of El Porvenir Radio Show to other projects (Radio Show).
- Change the structure of the public institution questionnaire. Focus with the interviews at rural areas rather than urban areas (3.7 Future Survey: Recommendations).