

Grande and Pequeño Impacts:

A Socioeconomic Analysis to Landowners from the Agricultural Water Distribution System in the Cochapamba Grande Region of Quinego

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THE ABSTRACT

Cuenca, Ecuador is unique in the country for its high quality potable water. The quality of the water is threatened in multiple ways, including from small-scale ranching. The regional entity managing water resources, ETAPA, has worked with landowners to implement a new system for providing water to cattle that is intended to reduce contamination of the river water from organic wastes. We conducted a socioeconomic analysis of the impacts to the landowners from the implementation of the system by learning how the water distribution system is used in practice and interviewing six landowners to understand how they are impacted. We found impacts on intercommunal relationships and landowner agricultural production. Additionally we addressed challenges that ETAPA faces to protect water resources.

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TABLE OF CONTENTS

Abstract	ii
Acknowledgements	iii
Authorship	iv
Chapter 1: The Opportunity	1
Chapter 2: The Background	2
2.1 Smallholder Farms in Cochapamba Grande	2
2.2 The System’s Purpose, Implementation Process, and Use	7
2.3 Overview	12
Chapter 3: The Approach	12
3.1 Objective One: Identifying Challenges	12
3.2 Objective Two: Gaining an Understanding of the Water Distribution System	13
3.3 Objective Three: Learn About System Impacts Through Interviews	13
Chapter 4: The Findings	15
4.1 Perceptions of Julia Maria Caivinagua Caivinagua About the Impacts from the Water System	15
4.2 Perceptions of Luz Maria Hurtado Carreño about the Impacts from the Water System	18
4.3 Perceptions of Luis Benigno Uyaguari Guartatanga About the Impacts from the Water System	20
4.4 Perceptions of Luis Miguel Coraisaca Coraisaca about the Impacts from the Water System	23
4.5 Perceptions of Segundo José Frias Frias About the Impacts from the Water System	25
4.6 Synthesis of Individual Impacts	27
4.7 Introduction to Social Impacts	28
4.7.1 Few Landowners Perceived Impacts on Community Collaboration	28
4.7.2 A Majority of the Landowners Perceived Fair Usage of the System	29
4.8 Introduction to Economic Impacts	29
4.8.1 The Impact on Farm Productivity is Unclear	29
4.8.2 It is Unclear if the Level of Contamination in the Cattle’s Water Decreased	30

4.8.3 Some Landowners Claimed an Increase in Land Value Because the System was Implemented	30
4.9 Limitations	31
Chapter 5: The Challenges and Possible Approaches	31
5.1 Challenges	31
5.1.1 Different Expectations Between ETAPA and Landowners	32
5.1.2 Water Contamination	32
5.1.3 Fairness in the Access and Use of the Water System	33
5.2 Future Research Questions	34
5.3 Conclusion	34
Works Cited	35
Appendices	37
Appendix A: Question Asked During Guided Tour With Landowners	37
Appendix B: Questions Asked During Guided Tour With ETAPA Engineer	38
Appendix C: Interview Questions	39
Appendix D: Survey Questions About Basic Landowner Data for ETAPA to Use	43
Appendix E: Socioeconomic Analysis Deliverable	44

LIST OF FIGURES

Figure 2.1: A Map of the Water Recharge Area	3
Figure 2.2: The Fence Around the Natural Water Source	4
Figure 2.3: Rainwater Falls in the Mountains and Runs off into the Natural Water Source	4
Figure 2.4: The Natural Vegetation in Cochabamba Grande	5
Figure 2.5: The Natural Vegetation in Cochabamba Grande	5
Figure 2.6: The Natural Vegetation in Cochabamba Grande	5
Figure 2.7: Different Landowners Building the System	8
Figure 2.8: Different Landowners Building the System	8
Figure 2.9: Different Landowners Building the System	8
Figure 2.10: Different Landowners Building the System	8
Figure 2.11: The Tank ETAPA Implemented	9
Figure 2.12: The Protective Fence around the Natural Water Source	9
Figure 2.13: A Capitation Point that ETAPA Implemented into the System	10
Figure 2.14: A Capitation Point Added to the System by the Landowners	10
Figure 2.15: A Hose Extension Added by a Landowner	10
Figure 2.16: A Map of the Water Distribution System	11
Figure 3.1: Map of the Interview Locations and Interviewees Properties	14
Figure 4.1: Julia Maria Caivinagua Caivinagua, and Group Members	15
Figure 4.2: Luz Maria Hurtado Carreño, her Grandson, and Group Members	18
Figure 4.3: Luis Benigno Uyaguari Guartatanga and a Group Member	20
Figure 4.4: A Leaking Capitation Point	22

Figure 4.5: Luis Miguel Coraisaca Coraisaca and a Group Member	23
Figure 4.6: Segundo José Frias Frias Working While Being Interviewed by Group Members	25
Figure 4.7: The Water Tank Used by Segundo for Watering his Crops, Livestock, and Pasture	36
Figure 5.1: Example of a Rock and Sand Filter	33

LIST OF TABLES

Table 2.1: The Projected Change in Temperature and Precipitation in the Andean Region	7
Table 4.1: Synthesis Table of the Individual Impacts from the System	27

1: THE OPPORTUNITY

Cuenca, Ecuador is unique in South America for having readily available potable water. Empresa Pública Municipal de Telecomunicaciones, Agua Potable, Alcantarillado y Saneamiento, Subgerencia de Gestión Ambiental, (ETAPA) is the governmental agency that is responsible for protecting natural water sources and providing water for human consumption. In ETAPA, the division Programa Manejo Integrado de Cuencas para la Protección de Fuentes de Agua (MICPA) is responsible for the protection of water sources throughout Cuenca and neighboring communities. One such community is Cochapamba Grande which is located in a valley in the Quinego Parish. This community consists of 20 landowners that altogether produce milk, beef, guinea pig, corn, lamb, and pork among other products for both consumption and a source of income. At the bottom of the valley, there is a river that collects the runoff from the watershed that borders many of the landowners' properties which is used downstream for human consumption.

In Cochapamba Grande, water source contamination was becoming an increasing problem through two main factors:

1. Cattle defecating directly into the water source
2. Cattle being taken down to the water source to drink thus eroding the river bed and increasing the amount of sediment particles that enters the water source (Peralta, Bustamante Quezada, 2019).

ETAPA's goal is to keep local water sources from being contaminated. ETAPA is required to protect water sources according to Article 12 of Title 1 of Ley Orgánica de Recursos Hídricos, Usos y Aprovechamiento del Agua (2014). In 2018, ETAPA implemented an agricultural water distribution system for the landowners to use instead of the river that runs through the basin. The system acts as an isolated water source for the landowners, separate from the river. Besides protecting a water source used for human consumption, ETAPA had two other goals for the implementation of the system:

1. Improve the productivity of the landowners
2. Strengthening collaboration in the community through the management of a public resource (Peralta, Bustamante Quezada, 2019).

While working with ETAPA, the goal of our project was to investigate the social and economic impacts to landowners resulting from the implementation of the agricultural water distribution system in Cochapamba Grande. To achieve this goal, we completed three objectives:

1. Identify challenges that the landowners face in regard to agricultural water usage for pasture growth and livestock consumption
2. Gain an understanding of the water distribution system and its usage by the landowners
3. Investigate how the agricultural water distribution system has affected the social and economic conditions of the landowners.

To complete these objectives, we went on guided tours of the system, participated in communal meetings, attended Mingas, and conducted interviews with landowners. Through these actions, our group found perceived impacts to communal relationships, the relationship between ETAPA and the landowners, fair usage of the system, farm productivity, access to water,

water contamination, and land value. Additionally, our group identified challenges that ETAPA faces in the community with possible approaches ETAPA can utilize. Knowing these impacts, ETAPA can adjust their design and implementation strategy for new projects in Cochapamba Grande and in future communities.

2: THE BACKGROUND

In this chapter, we begin by discussing the smallholder farms in Cochabamba Grande and the problems that they face. After this, we examine ETAPA's reasoning for designing and subsequently implementing the agricultural water distribution system. Then, we discuss the process of implementing the system and how the ETAPA intends the system to be used by the landowners. Lastly, we identify the need for further research on the landowners due to the impacts from the system.

2.1: SMALLHOLDER FARMS IN COCHAPAMBA GRANDE

In 2016, ETAPA identified the threat of contamination of a water source in a water recharge zone used for human consumption in Cochapamba Grande (Peralta, Bustamante Quezada, 2019). Cochapamba Grande is a farming community of 116 hectares that are split up into 134 different farm-lots of sizes 0.00122 hectares to 4 hectares. These 116 hectares are shared by around 20 landowners (Bustamante Quezada, Personal Email, 2018). Downstream from this community, water is collected for human consumption by the Cochapamba Grande Water Board (Peralta, Bustamante Quezada, 2019). In the area, there are three main streams that are used for water recharge as shown in Figures 2.1 and 2.2. The main stream is centralized in the ravine and collects the two smaller streams. The area that is used for farming is heavily sloped, demonstrated in Figure 2.3, and changes in elevation from 3,240 meters at the top to 2,980 meters near where the streams are located (10,630 feet to 9,777 feet). In addition, Cochapamba Grande landowners are also dealing with the problems of lack of arable land, migration, and rural poverty.

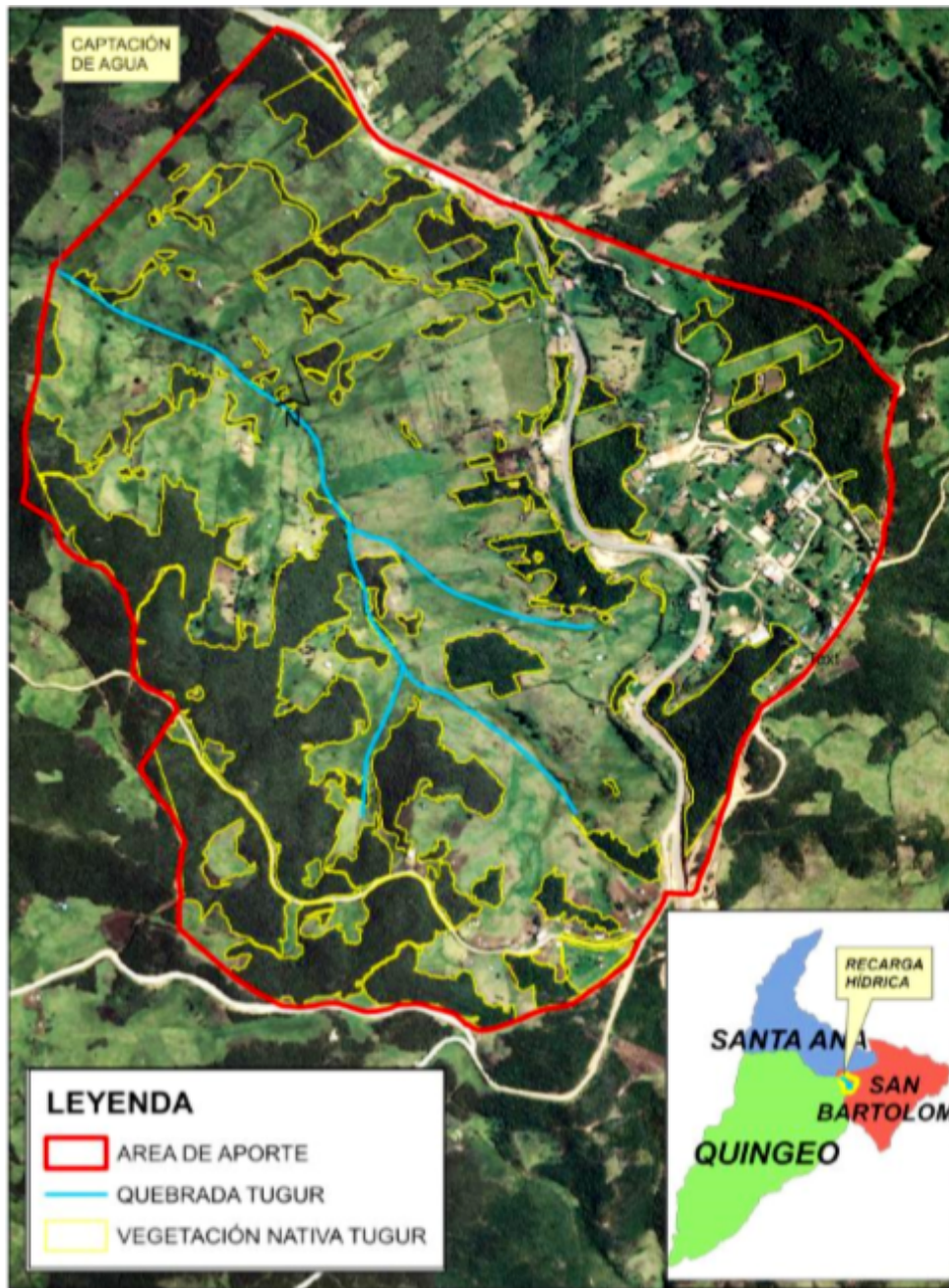


Figure 2.1: A Map of the Water Recharge Area

The red line outlines the water recharge zone where all the runoff flows into the stream, indicated in blue. The stream continues to the point where the Cochapamba Grande Water Board uses the water for human consumption. (Peralta, Bustamante Quezada, 2019)



Figure 2.2: The Fence Around the Natural Water Source



Figure 2.3: Rainwater Falls in the Mountains and Runs off into the Natural Water Source

First, lack of arable land is a challenge for the landowners of Cochapamba Grande as it decreases the productivity of farmland. Lack of arable land in Cochapamba Grande is caused by two factors:

1. Soil Erosion
2. Deforestation (Peralta, Bustamante Quezada, Personal Interview, 2019).

According to the Ministry of Agriculture in Ecuador, over 50 percent of the country is affected by soil erosion with the most affected region being the Andean region where the percentage rises to 70 percent (Shukla, Nobre, & Sellers, 1990). When land is affected by soil erosion, there is decreased agricultural productivity because of the loss of nutrients in the soil such as nitrogen and phosphorus (Montgomery, 2007). In Cochapamba Grande, cattle farming practices deplete the land's resources causing the landowners to deforest land (Peralta, Bustamante Quezada, 2019). Deforestation expands land for more pasture area; however, this approach is a short-term solution to the problem of limited arable land. In Cochabamba Grande, 33 percent of the land is native vegetation and the area is at risk for further loss of native vegetation (Figure 2.4, 2.5 and 2.6) (Peralta, Bustamante Quezada, 2019).



Figures 2.4, 2.5, 2.6: Natural Vegetation in Cochabamba

Second, the migration of farmers impacts the smallholder farms in Cochabamba Grande. Farmers can migrate either internationally to find better opportunities abroad or nationally into cities where there are higher paying job opportunities. In Cañar, located in the Andean Highlands 80 kilometers from Cochabamba Grande, thousands of farmers have migrated to metropolitan places such as the New York City (Jokisch, 2002). Two possible conditions are regularly hypothesized for the early phases after migration:

1. The removal of labor threatens the agricultural production in the area
2. Remittances from labor overseas surpasses income from local labor and provides capital to make agricultural improvements.

In the Andean region, Jokisch (2002) stated that typically immigration damages agricultural communities and found no evidence that related migrant status and an increased agricultural productivity due to remittances.

Third, smallholder farms in Cochapamba Grande are challenged by persistent rural poverty. In Ecuador, forty percent of the population lives in rural areas and of that, two-thirds of them are affected by poverty (World Bank, 2004). According to the World Bank, agricultural laborers are among the poorest households in Ecuador. The two most relevant causes for rural poverty in the Cochapamba Grande region are:

1. Unequal distribution of land
2. Climate change (Caivinagua, Personal Interview, 2019).

In Cochapamba Grande, over time land has been split up through inheritance into pieces of different shapes and sizes. This leaves landowners with multiple pieces of land that are not conducive to productive farms (Caivinagau, Personal Interview, 2019). Additionally, ETAPA buys the uppermost land, which is home to native vegetation, to protect water sources as the uppermost areas are the most critical for water source protection (Bustamante Quezada, 2018). This prevents landowners from expanding their agricultural land to protect natural water sources.

Climate change can lead to extreme weather conditions which can cause farmers to lose economic capital over time (Aviles, personal interview, 2019). Over the last 10 years, rainy months have become rainier while dry months have become drier (Table 2.1) (Aviles, 2019). Extremely dry or wet weather conditions are both bad for farmers because both extreme wet and dry conditions affect agricultural productivity negatively (Myers, 2019). With excess rain, oxygen and other nutrients are stripped from the soil, decreasing the amount of cellular respiration among other vital plant processes until the plant dies (Government of Manitoba, n.d.). Excess water will over time deteriorate soil quality by stripping nutrients from the soil in runoff. A lack of water will dehydrate crops and pasture land and increase the amount of soil erosion through wind (Santra, Moharana, Kumar, Soni, Pandey, Chaudhari, & Sikka, 2017). In Cochapamba Grande, landowners do not know how to react to these conditions and suffer a loss in income (Coraisaca, Personal Interview, 2019).

Table 2.1: The Projected Change in Temperature and Precipitation in the Andean Region (Aviles, 2019).

RCP 4.5	TEMPERATURE (°C)		PRECIPITATION (%)	
	INCREASE	DECREASE	INCREASE	DECREASE
JANUARY	0.7		36	
FEBRUARY	0.8		42	
MARCH	0.6		20	
APRIL	1.0		17	
MAY	1.2			11
JUNE	1.4			27
JULY	1.9			42
AUGUST	1.8			15
SEPTEMBER	1.6			35
OCTOBER	1.1			34
NOVEMBER	0.5			29
DECEMBER	0.3		4	

2.2: THE SYSTEM'S PURPOSE, IMPLEMENTATION PROCESS, AND USE

Before the implementation of the agricultural water distribution system, water contamination was becoming an increasing problem through two main factors:

1. Cattle would defecate directly into the water
2. Cattle would be taken down to the water source to drink thus eroding the river bed and increasing the amount of sediment particles that enters the water source (Peralta, Bustamante Quezada, 2019).

Article 12 of Title 1 of Ley Orgánica de Recursos Hídricos, Usos y Aprovechamiento del Agua (2014) is an Ecuadorian law which states that government agencies need to take steps to protect water sources. When ETAPA observed the contamination of the water source in Cochapamba Grande, they needed to take action to protect the water source in accordance to the law (Bustamante Quezada, Personal Interview, 2019). To protect the water source, ETAPA decided to build protective fencing around the river in order to keep landowners from bringing their cattle directly there. ETAPA then designed a water storage tank to supply landowners with water that is separate from the river. ETAPA also had secondary goals when designing this system of improving the productivity of landowners and to strengthen collaboration in the community (Peralta, Bustamante Quezada, 2019).

The process of implementing the agricultural water distribution system was one that included input from both the landowners and ETAPA. Originally, the system was designed to be 5 cubic meters and was located in a different area in the valley. After numerous community meetings, it was decided that the tank was to be increased to the 20 cubic meters so that more landowners could use the system (Peralta, Bustamante Quezada, 2019). This change was driven by the landowners and was possible due to the financial contributions of the Cochapamba Grande Water Board. To build, it required 13 Mingas of combined effort between ETAPA and the landowners to finish the project (Figure 2.7, 2.8, 2.9 and 2.10). Mingas are a day where all physically capable members of a community come together to work on one specific project. During the process, in order to demonstrate ETAPA's dedication in supporting the landowners, ETAPA gave them grass seed and fertilizer (Peralta, Bustamante Quezada, 2019).



Figure 2.7, 2.8, 2.9 and 2.10: Different Landowners Building the System

The system consists of a concrete tank without a cover (Figure 2.11), a kilometer of piping that is buried underground, and 1,850 meters (6070 feet) of fence (Figure 2.12) around the natural water source that flows through the area (Bustamante Quezada, Personal Email, 2018). Along the kilometer of piping are 26 taps, known as capitation points, that allow the landowners to access water from the tank (Figures 2.13). Farmers can also make modification to their capitation points and add hoses as shown in Figures 2.14 and 2.15.



Figure 2.11: The Tank ETAPA Implemented



Figure 2.12: Protective Fence around the



Figure 2.13: Capitation Point that ETAPA Implemented into the System



2.14: A Capitation Point Added by the Landowners into the System



Figure 2.15: A Hose Extension Added by a Landowner

The water storage tank was implemented in the location that was determined to have the highest rate of rainfall recharge (Bustamante Quezada, 2018). Once water collects in the tank, it is then gravity fed to the capitation points (Figure 2.16). ETAPA designed these capitation points to allow easy access for the landowners to have readily available water for agricultural purposes. To use the system, landowners take buckets down to where their capitation point is located. Once filled, landowners then carry the buckets of water to where they need them. Landowners can also add hoses to the system to reduce the distance they have to walk (Figures 2.14 and 2.15).

UBICACIÓN DE ZANJA DE DESVIACIÓN DE AGUA RESIDUALES

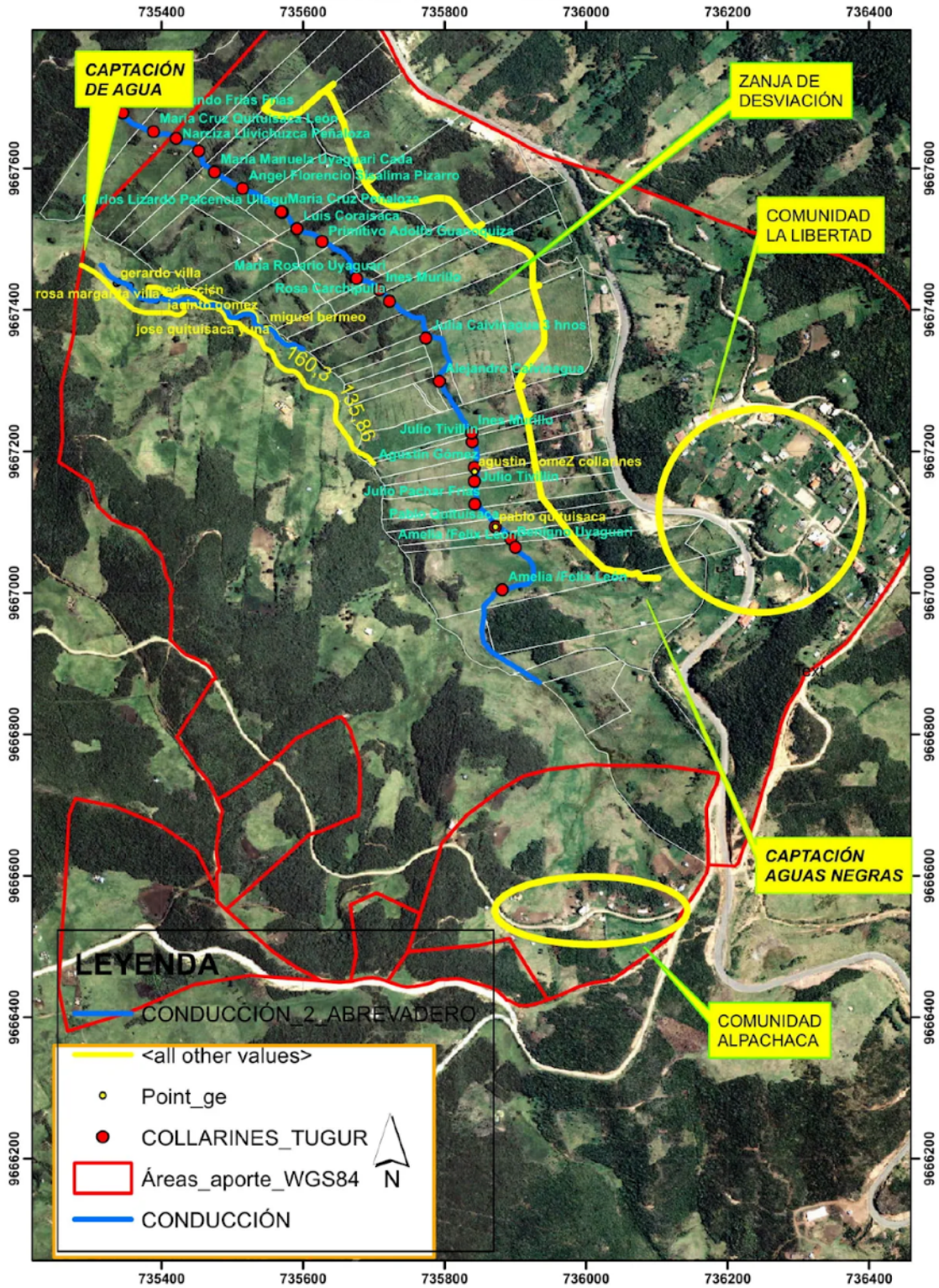


Figure 2.16: A Map of the Water Distribution System

A map of the implemented water distribution system with the capitation points (red) and which landowners use each capitation point (teal).

2.3: OVERVIEW

An ideal outcome for ETAPA would be that the entire community is using the water system in a way that is both sustainable and productive for the landowners. Instead, there are challenges that both ETAPA and the landowners face that prevents this ideal scenario from happening. ETAPA wants to learn about the social and economic impacts from the system on the landowners so that they can better understand their livelihoods to improve the protection of the water source while simultaneously aiding landowners in the future.

3: THE APPROACH

The goal of our project was to investigate the social and economic impacts to landowners resulting from the implementation of the agricultural water distribution system in Cochapamba Grande. The analysis is intended to understand the impacts of the system on the landowners for ETAPA to be able to adjust their design and implementation strategy for new projects in Cochapamba Grande and in future communities. To achieve this goal our group completed the following objectives:

1. Identify challenges that the landowners face in regard to agricultural water usage for pasture growth and animal consumption
2. Gain an understanding of the water distribution system and its usage by the landowners
3. Investigate how the agricultural water distribution system has affected the social and economic conditions of the landowners.

3.1 OBJECTIVE ONE: IDENTIFYING CHALLENGES

We investigated the difficulties landowners faced in relation to the quantity and quality of water they use for agricultural purposes. Our team toured the water system with three of the landowners. When we talked to the landowners during these tours, we focused our questions on the accessibility of water before the system was put in place and the impacts of the system. We asked the questions found in Appendix A and took personal notes during the tour. From doing this, our group gained insight into the daily difficulties the landowners face with access and use of water. We also worked with four landowners for a day helping them vaccinate their cattle. We observed how landowners interact in the community and how they collaborate. Additionally, our group attended meetings with groups of landowners to discuss the current state and future plans of the system. At these meetings we observed how the landowners and ETAPA interact.

3.2 OBJECTIVE TWO: GAIN AN UNDERSTANDING OF THE WATER DISTRIBUTION SYSTEM

We investigated the differences between how ETAPA intended the system to be used and how the landowners actually used it. In order to do this, we toured the water system as described in Section 3.1 and again with an ETAPA engineer (see Appendix B for questions asked during the tour with an ETAPA engineer). During the tour with the ETAPA engineer, we all took separate notes and then combined the data at the end. Before we could understand the impacts from the system, we needed to understand how the landowners interact with it. This information was then used to create interview questions.

3.3 OBJECTIVE THREE: LEARN ABOUT SYSTEM IMPACTS THROUGH INTERVIEWS

To understand the social and economic impacts of the water distribution system on the landowners, our group interviewed six of the 20 landowners about what they perceived to be the impacts of the system. The social impacts we wanted to address were the themes of the landowner's relationship with ETAPA, community collaboration, and equity. The economic impacts that we wanted to address were the themes of access to water, contamination of water, pasture productivity, and land value. We used a convenience sampling approach of the landowners to select who we interviewed. Interviews were completed in the locations shown in Figure 3.1. Our team conducted semi-structured interviews in which we did not have a strict script of questions but rather an initial set of questions where we could then probe and come up with new questions throughout the course of the interviews. Our initial set of questions are in Appendix C. These interviews were recorded, transcribed, and then translated into English. To analyze the data, our team created profiles for five of the landowners that we talked to and then compared the perceived impacts of the landowners. From these, our group created the socioeconomic analysis and identified challenges in the community as well as a set of approaches that ETAPA can utilize to address these challenges.

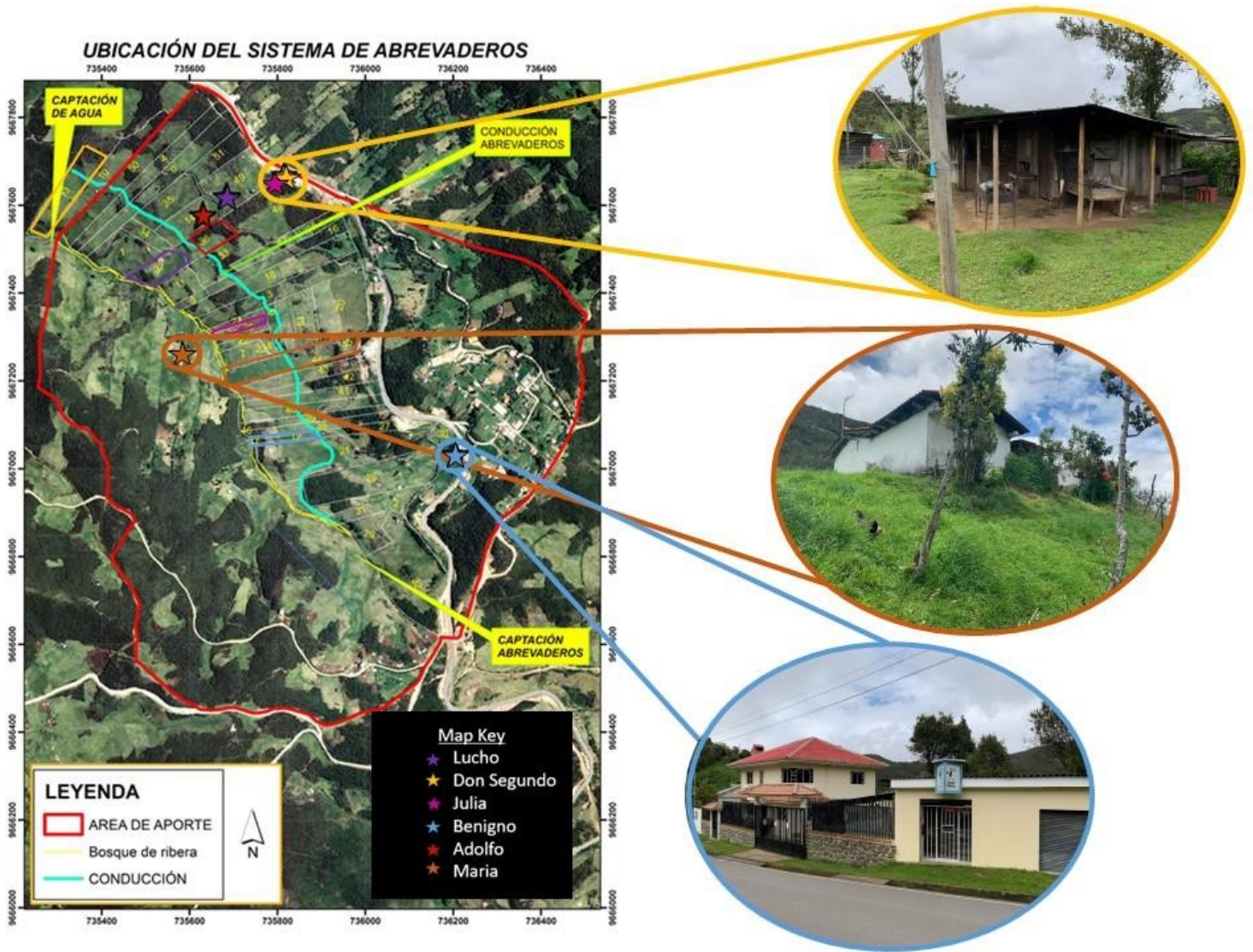


Figure 3.1: Map of the Interview Locations and Interviewees' Properties

A map of the locations of the interviews in relation to the water system that is traced in teal. Interview locations are marked with stars and color coded to match where the landowners' farms are located.

4: THE FINDINGS

In this chapter we present data from our interviews, group meetings, Mingas, and guided tours. We first present profiles of each landowner that we interviewed. These profiles contain individual backgrounds and their perceptions of the social, economic, and process impacts resulting from implementation of the water system. The purpose of this section is to create an understanding of how each landowner perceived impacts from the system. We follow these profiles with a table that summarizes the impacts on each landowner that we interviewed. Then, we include an overall discussion on the impacts, comparing each of the responses together. Lastly, this chapter describes the limitations that we had while conducting our approach.

4.1: PERCEPTIONS OF JULIA MARIA CAVINAGUA CAVINAGUA ABOUT THE IMPACTS FROM THE WATER SYSTEM



Figure 4.1: Julia Maria Caivinagua Caivinagua and Group Members

Julia (Figure 4.1) is one of the landowners in the area who has a piece of land that is 1,900 meters squared (20,451 square feet). In addition to the land in Cochapamba Grande, she has two other pieces of land for farming. She uses the Cochapamba Grande piece of land for cattle and for harvesting grass to feed to her guinea pigs. We then asked where her crops and livestock are located and she replied, “I do not have anything here, it's just a pasture for the cattle. Down in my house I have guinea pigs, chickens. I have plants, freshly planted, apples, pears, blackberries.” As a supplementary income, her husband works while she farms.

Julia perceived the water distribution system to have both positive and negative impacts on:

1. Her relationship with ETAPA
2. Productivity of her farm.

First, the process of implementing the agricultural water distribution had both positive and negative impacts on Julia’s relationship with ETAPA. Julia talked about ETAPA coming into their community and introducing themselves by giving landowners seeds and fertilizers. Julia said, “Yes, first the engineer [ETAPA] gave us seeds, and fertilizer to throw. So with that we sowed and fertilized. It makes us beautiful grass and we can raise more animals.” Receiving the seeds from ETAPA increased the relationship between Julia and ETAPA. This also had a secondary positive economic impact for Julia by improving her pasture.

Additionally, the compromises that ETAPA had to make while designing the system had a negative impact on the relationship between Julia and ETAPA. When asked how the implementation of the system affected Julia’s relationship between her and ETAPA, she said, “I think that I would like the engineer to be a little more serious. That's why I tell the engineer that he has to think on both sides, because we work, and they rest. Do they come wash their hands and, drink the water? I do not think so.” Julia believes that she and the other landowners were not listened to when the system was designed and implemented. The quote demonstrates that Julia feels that the engineers from ETAPA are disconnected from the landowners and do not fully understand the realities of their livelihoods.

Second, the implemented water distribution system has had positive economic impacts for Julia by increasing the productivity of her farm. Julia feels as though the water distribution system allows for more consistent milk production from her cows. When asked about this, Julia said, “Sometimes the cattle do not want to take the dirty water [referring to the water in the stream]. On the other hand, if it is brought from the new system it is improved enough and the cattle take it [referring to the water from the system] calmly.” Cows that drink more water from the system produce more milk as they are better hydrated. Stable milk production creates a steadier flow of income from Julia’s farming practices.

Even though the water system has positive economic impacts for Julia, the system does not have any economic impacts for her other areas of land. When asked how many plots of land she owns, Julia said that she only has cattle and pasture land in Cochabamba while she has crops and other livestock on her other farms. When speaking about the differences in her farm land, Julia stated, “the help was for here [referring to the water system] and my production is elsewhere.” She then went on to say that she was thinking about moving more of her crops and livestock over to Cochapamba Grande. However, this would have a negative impact on Julia as it would take time and resources in order to move her livestock and crops to this plot of land. It is

also unclear if making the decision to move to Cochabamba Grande would have positive economic impacts for Julia. During the interview Julia said, “the piece [of land] that I have is very tiny. I think it's 17 [meters] wide by 80 [meters] long. Down, in the center I have more. And around my house it's regular.” As stated in Section 2.1, small pieces of land are not conducive to farming. Even with the water system, it is unclear if her land can support more agricultural practices. This could also create an impact on other landowners as Julia would then require more water from the system.

Julia stated that the implemented water distribution system has had positive impacts on:

1. Her community relations
2. The value of her land.

First, Julia feels that the introduction of the water system has had a positive impact on her collaboration and relationship with other landowners. While discussing her work, Julia talked about how she was forced to stop farming due to personal injuries. Later in the interview, Julia was asked if she thinks the water distribution system affected the way she interacts with the community. Julia said, “I retired because nobody supported me. Now, we are united, hopefully we will continue like this.” Julia thinks that the impact that the water distribution system has had on her is significant as it allows her to continue farming. Not only does this have a positive impact on community relations for Julia, but there is also a positive economic impact because she can now farm again and generate an income.

Second, Julia perceives that the water distribution system has had a positive economic impact by raising the value of her land. When asked about the value of her land, she disclosed, “I have my house evaluated for \$22,000. And now the land that I just bought myself cost me at \$15,000. From here I do not know about 4 or 5 thousand dollars.” Then, Julia was asked if she believes that the water distribution system affected the value of her land, Julia stated, “Yes, with the right to water we can charge more because we have the option of picking up and bringing [water] to the cattle, they do not have to go down to the water.” Julia perceives that she can now sell her land for a higher value due to the increased access to water on her property.

4.2: PERCEPTIONS OF LUZ MARIA HURTADO CARREÑO
ABOUT THE IMPACTS FROM THE WATER SYSTEM



Figure 4.2: Photo of Luz Maria Hurtado Carreño, her grandson, and group members

Maria (Figure 4.2) is a landowner in the region with a property that is 19,200 meters squared (206,667 square feet). Maria has been farming on this land for 25 years with her husband. She uses the land to farm five cows, 20 guinea pigs, and 20 chickens. She produces cheese with the milk from her cows which she sells at a nearby bakery.

Maria perceived three positive impacts that emerged from the implementation and usage of the system on

1. The contamination of the water
2. Her access to water
3. Her property value.

First, Maria experienced a positive impact on the level of contamination in the water due to the system. She said that the system stops the “animal rubbish” from contaminating the water. Maria is referring to the cow feces that lined the river bed before the system, which now are no longer trampled into the runoff as they were before.

Second, Maria found there to be a positive impact on her access to water because there is more water available in the system for her than there was in the river. Maria noted that her hose is always full and that when the capitation point is opened, water comes out with a strong force. She is able to give to her cattle water three or four times a day, compared to before the system when she gave her cattle water once per day. She stated that she used to have to walk the cows to the river to give them water. She said, “To get water was kind of hard. It took work. Now, with the system, it's not hard. I'm not walking to the stream with the animals anymore.” This increase in access has benefited her as she used to fall on her way to give the cows water, limiting the amount of water the cattle drank.

Third, Maria noted a positive impact of the system on the value of her property. When asked if there was a change in the value of her land, she exclaimed, “Well of course there's a change.” She proclaimed that easier access to water made her land more valuable.

Maria noted one negative impact due to the system:

1. The initial and monthly cost of the system.

A negative impact on Maria because of the system is the cost for her to use the system. Maria noted that there was an initial charge for her to be able to use the system of \$150. In addition, she mentioned another monthly charge that she described as, “I have to pay him [the ETAPA engineer] the money to let me go to the meetings.” From our meetings with other landowners, we gathered that this monthly cost is actually for the continued usage of the system. Her tone in the quote expressed her negative feelings towards the payments.

Maria also noted no impact from the system on

1. Her community interactions.

Through her non-attendance at meetings, Maria has not seen a change in her interaction with other landowners in the community. As Maria stated, she is old and therefore does not attend activities such as meetings or Mingas. When asked if she thought that she interacted with other members of the community more, she dismissed the question saying that they are all neighbors and know each other.

4.3: PERCEPTIONS OF LUIS BENIGNO UYAGUARI GUARTATANGA ABOUT THE IMPACTS FROM THE WATER SYSTEM



Figure 4.3: Photo of Luis Benigno Uyaguari Guartatanga and Group Members

Luis Benigno Uyaguari Guartatanga (Figure 4.3) is a landowner with one, 2,400 meters squared (25,833 square feet) property along the path of the water system and two others in Cochapamba Grande. His home is located near the system at the top of the hill overlooking the water tank. By his home, he grows crops such as corn, beans, and potato that he uses to feed his family of six. On his plot of land in Cochapamba Grande, he grows grass to feed his guinea pigs. He sells these guinea pigs as a source of income. As a backup source of income, he has a carpentry business as well as a small convenience store that he runs next to his house.

While Luis Benigno stated that there was no impact, through his description of other impacts of the system Luis Benigno described impacts on:

1. His access to water
2. His personal economics.

First, Luis Benigno stated that his access to water did not change because of the water system. As we asked more questions, he then proceeded to say that the system allowed him to grow more grass than he could before, thus contradicting his previous statement and indicating a positive economic impact. He stated that this increase in grass production led to more guinea pigs that were larger when he said, “Yes, and they are larger. If there is more food, we can have more...” Having more and larger guinea pigs allows Luis Benigno to increase the amount of guinea pigs that he sells, possibly for a higher price due to the increased size.

Second, he feels that the water system has had no impact on his personal economic conditions because the the new system has not fully solved the problem he faces with lack of access to water. He continues by stating that there are periods of water scarcity during the summer months when the system and river dry up, but by switching to being a carpenter he maintains a stable income. However, the lack of water in the system does have a negative impact economically on Luis Benigno as he does not have enough water to grow food for his family during this time, forcing him to buy it instead.

Luis Benigno did not perceive enough of an impact from the implementation and usage of the system on:

1. The contamination of water.

Luis Benigno stated that he does not believe that the new water distribution system has had an impact on the contamination of the water. When asked if the water in the new system had less contamination, Benigno claimed that the only difference between the system and the river used before was that the cattle would no longer trample the stool alongside the river. While this does remove contamination of the water, Luis Benigno is either unaware of the harm that cattle defecation has when in or near rivers or does not perceive the change to have decreased the contamination.

Luis Benigno also expressed his views about two important impacts during the interview that highlight social impacts from the introduction of the water system:

1. He believes landowners abuse the water system by not shutting off their capitation points
2. The relationship between landowners and ETAPA has not improved.

First, he has a suspicion that the other landowners are abusing the use of the system by not shutting off their capitation points thus wasting the water from the system. Benigno said, “There are many people who open the key and forget [to close it], and then the water is wasted”.

This leads to a constant leak of water (Figure 4.4) from the system which then leaves less water for the other landowners. His suspicion of others' behaviors suggests how social and economic impacts are related; he believes others are wasting water which impacts the availability of water in drier periods, which then affects the productivity of his farm.



Figure 4.4: A Leaking Capitation Point

Second, Luis Benigno did not feel that the system positively impacted the landowners' relationship with ETAPA. He had a negative outlook on how the other landowners viewed the implementation of the system saying, "They did some work for us so we should be grateful." Luis Benigno is happy that ETAPA is helping the landowners while showing a disappointment in the other landowners wanting more from ETAPA instead of stopping to thank them for the help they had already given.

4.4: PERCEPTIONS OF LUIS MIGUEL CORAISACA CORAISACA ABOUT THE IMPACTS FROM THE WATER SYSTEM



Figure 4.5: Photo of Luis Miguel Coraisaca Coraisaca and a Group Member

Luis Miguel Coraisaca Coraisaca (Figure 4.5) owns one property along the water distribution system that is approximately 6,300 meters squared (67,813 square feet). He recently moved to his current home on the top of the hill overlooking his farm and is currently in debt to the bank from purchasing the home. He has 16 cattle and his main source of income is from selling the milk that his cattle produce. He also grows corn and beans on his land and used to have goats, sheep, and pigs on his farm before they were stolen.

Luis stated that the water system fails to make enough of an impact on:

1. The contamination of the water
2. The amount of water he can use for his farm.

First, he perceived that if the water in the distribution system was cleaner, then he would not have to spend time and money on vaccinating his cattle every three months. Luis vaccinates his cattle to avoid his cattle getting sick from what he believes is contaminated water. The vaccination of his cattle taints the cattle's milk for two days, so that he is unable to sell his milk for that time. When the vaccinations are not sufficient and the cattle become sick, Luis has to trade these cattle for new ones at a loss between \$100 and \$150. Luis also said that he avoids purchasing better dairy cattle due to their chance of getting sick. Thus, Luis feels as though the lack of clean water in the system is stopping him from improving his herd.

Second, he claimed the water distribution system does not provide enough water for his pasture. He is concerned about the amount of grass that can grow on his land because of the amount of water provided by the system. The lack of growth of the pasture causes the cattle to grow to a smaller size and produce less milk, thus leaving Luis with less income than desired.

4.5: PERCEPTIONS OF SEGUNDO JOSÉ FRIAS FRIAS ABOUT THE IMPACTS FROM THE WATER SYSTEM



Figure 4.6: Segundo José Frías Frías Working While Being Interviewed by Group Members

Segundo José Frias Frias (Figure 4.6) is a landowner who owns property in the area of the water distribution system. His property is 11,300 meters squared (121,632 square feet). He owns the last property that the piping from the system reaches but does not use the system because he has his own water tank that is located closer to his farm. He uses this other system to water his crops, pasture, and livestock as well as cook his food (Figure 4.7). The livestock on his farm include cows, chicken, sheep, and guinea pigs.



Figure 4.7: The Water Tank Used by Segundo for Watering his Crops, Livestock, and Pasture.

Segundo explains that the water system has had a positive impact on

1. His social interaction within the community.

Even though Segundo does not use the water system, he perceives it as having a positive impact on his social interactions within the community. He stated that he supports the other landowners that use the system, as shown by his presence at the meetings about the system. Further, this is demonstrated by allowing meetings as well as two of our interviews to occur on his property. Segundo stated, “I like to support them. Because that's the way it should be.” Segundo supports others in the community which therefore impacts him positively as other landowners support him too.

4.6: SYNTHESIS OF IMPACTS

Table 4.1: Synthesis Table of the Individual Impacts from the System

<u>Impact Category</u>	<u>Impact Subcategory</u>	<u>Impact</u>	<u>Landowner</u>
Social	Process	Increased Relationship with ETAPA	Julia
		Decreased Relationship with ETAPA	Julia
	System	Increased Community Collaboration	Segundo
			Julia
		Increase Equity	Luis
			Segundo
			Julia
Decreased Equity	Luis Benigno		
Economic	Process	Gifted fertilizer and grass seed made better grass	Julia
		Landowners pay for the system	Maria
	System	Increased access to water	Julia
			Rosa
		Increased productivity	Luis Benigno
			Maria
			Julia
		Landowners pay money for the system monthly	Maria
		Perceived less contamination than river	Julia
			Maria
		Increased land value	Julia
Maria			

The table above is a synthesis of the individual impacts that were identified during our interviews with the landowners in Cochapamba Grande. Each impact is categorized into ‘Social’ and ‘Economic’ as indicated on the left of the table. Next to that, the impacts are then further categorized into ‘Process’ or ‘System’. ‘Process’ refers to the impacts that arose due to the design and implementation of the system. ‘System’ refers to impacts that occur after the implementation while using the system. The ‘Impact’ column includes all of the impacts that our group identified which are explained in more detail in the next sections. The ‘landowner’ column indicates how many and which specific landowners perceived the impacts. The table is the first step in synthesizing the individual information and looking at overarching impacts that affect multiple landowners in the community.

4.7: INTROCUCTION TO SOCIAL IMPACTS

This section is designed to explore how the individual landowner’s perceptions of impacts compare with those of the other landowners that we interviewed. Social impacts include relationships between landowners and landowners’ perceptions of each other.

4.7.1: FEW LANDOWNERS PERCEIVED IMPACTS ON COMMUNITY COLLABORATION

Three out of the five interviewed landowners did not see the water distribution system as having an impact on community relations. However, the other two landowners felt very strongly that the water system has had a positive impact on community relations. Both Julia and Segundo thought that they had seen an increase in the amount of collaboration with other community members after the system was implemented. Julia said she did not feel supported before the water system and now she feels the community is unified. This difference could be explained by both Julia and Segundo’s participation in the project. Julia is the elected secretary of the water system project while Segundo allows the meetings about the project to be held at his house. This suggests that the more the landowners are willing to participate in the project, the more they are inclined to work with other landowners. Adolfo and Luis, two of the landowners who felt there were no impacts on community collaboration, were at the meetings for the project, however, did not participate. Luis Benigno and Maria, the other two landowners, who perceived no impacts on community collaboration, were not present at any of the meetings.

Two out of the five landowners perceived positive impacts that came from increased community collaboration between landowners. The unification of the community that Julia perceived was displayed when some of the landowners traveled to various properties to help vaccinate cattle. During this process, the younger and stronger landowners went to different pastures, shared vaccination supplies, and helped to tie down cows. This collaboration had a positive economic impact on the landowners who participated since they could help share the cost of the vaccinations as well as it reinforced positive social relationships.

4.7.2: A MAJORITY OF LANDOWNERS PERCEIVED FAIR USAGE OF THE SYSTEM

Three out of five of the landowners felt that the system was fair for everyone using it. While Maria was unsure about the system's fairness, the only landowner who felt that the system was not fair was Luis Benigno. Luis Benigno believed that the system was not fair because landowners used unequal amounts of water. His belief that the usage of the system is unfair was reinforced when Maria stated that she likes to give water to her cattle three or four times a day. Maria stated that she knows that other landowners only give water to their cattle once a day and this can affect their milk production. Before the system, Maria could not have given water to her cows three or four times a day because of her physical condition, but now she can because she does not have to walk far to bring her cattle to the water source. Knowingly, Maria takes more water than other landowners to increase her own productivity. This impact is from the system as the potential increase in accessibility of water can allow landowners to use more than others. Luis Benigno also worries that landowners leave the capitation points open by accident, thus consuming water that could be used by other landowners.

The other landowners felt that the system was fair as everyone had a capitation point. However, during the interviews these landowners never addressed different landowners using too much water or leaving their capitation points open. Luis Benigno worries that without monitoring the amount of water that landowners consume, some landowners have negative impacts on others in the community.

4.8: INTRODUCTION TO ECONOMIC IMPACTS

This section demonstrates how the water system has affected landowners' economics. Economic impacts consist of impacts relating the landowner's productivity, access to water, the quality of water, and the land value.

4.8.1: THE IMPACT ON FARM PRODUCTIVITY IS UNCLEAR

It is unclear if the system has increased the productivity of landowners in the community. Three of the landowners felt as though the system did not impact their productivity, while two others did perceive a positive impact. The two landowners who had an increase in production perceived there to be more grass growing on their farms, allowing for cattle or other livestock such as guinea pig to grow bigger. For example, Luis Benigno was able sustain more livestock overall. This could be due to an improved access to water from the system. Landowners who perceived to have improved access to water also perceived an increase in farm productivity. For example, Maria stated in her interview that the system saves her time and energy because she no

longer has to walk her cattle down to the river. This improves her access to water as she was limited before by her physical condition and could not walk to give water to her cattle as many times as she is now. Julia also perceived herself to have an improved access to water and an improved productivity.

An observation from our interviews is that landowners who experienced an improvement in access to water, as well as an increase in farm productivity, live further from the tank than those who have not experienced an improvement. Luis did not perceive any change in his access to water and is located adjacent to the river. It is also important to note that none of the landowners said that the water distribution system had a negative impact on their total productivity.

4.8.2: IT IS UNCLEAR IF THE LEVEL OF CONTAMINATION IN THE WATER SOURCE HAS DECREASED

It is unclear if the system has given the landowners water with reduced contamination as two of the five landowners did not perceive an impact on the level of contamination in the water for their livestock. One of those two landowners, Luis, used the water from the system for his cattle. His cattle still occasionally end up diseased and being unable to produce milk for human consumption. Luis attributes this disease to the contamination in the water. However, Julia said that her cattle preferred the water from the system over the water from the river. She recalls that her cattle would sometimes not drink the water from the river because it was contaminated and further believes that the contaminated water reduced the amount of milk they produced. Julia's cattle's actions suggest to her that the water from the new system is less contaminated.

4.8.3: SOME LANDOWNERS CLAIMED AN INCREASE IN LAND VALUE BECAUSE OF THE WATER SYSTEM

While two landowners claim that the system has increased the value of their land, there is not enough evidence to claim that all the properties increased in land value or by how much the values changed. Julia bought her land in the last few years and told us that she could now sell her land for more money. Maria also exclaimed the obviousness of the fact that her land's value changed because of the system, adding that land value increased more with the addition of both water and fertilizer. With an improved access to water for some landowners, they perceived that their land value then increased. Not all landowners perceive an improvement in access to water which therefore indicated that they did not perceive an effect to the value of their land. There are multiple factors that can affect land value and with two responses of increased value, it is unclear if other landowners are affected in the same way or in the same magnitude as Julia and Maria.

4.9: LIMITATIONS

Our analysis was limited by four different factors:

1. In interviews, the landowners sometimes could not understand our questions due to the language barrier until we repeated it multiple times. Looking at their answers in our transcripts, it is obvious that they did not understand all of our questions.
 - A. The dialect of the landowners was one that even the fluent Spanish speaker that aided us in translating could not completely understand, thus affecting the transcripts of our interviews.
 - B. One landowner's dialect was too strong to understand and translate into English, limiting our data.
2. Half of the interviews that we scheduled were cancelled by the landowners, thus decreasing the number of interviews that we were able to conduct.
3. Due to the culture and the busy schedules of the landowners, any interview techniques that involved paper or drawing were not feasible.
4. With the combination of the language barrier and our limited time in the community, the purpose and goal of our project was not clear to the landowners.

5: THE CHALLENGES AND POSSIBLE APPROACHES

Through visits for interviews, Mingas, guided tours, and group meetings, our group observed and learned about the impacts from the agricultural water distribution system in Cochapamba Grande. Through our interviews and guided tours, it became apparent that the water system had varied impacts on the landowners that we interviewed. Socially and economically, landowners were affected differently based on their location, size, and distance from the water system. These impacts are included in the challenges and approaches that we have identified for ETAPA.

5.1: CHALLENGES

From our field work, our team has identified three challenges that ETAPA faces in the community. These challenges are the differing expectations between ETAPA and the landowners, the contamination of the water in the system, and how to use the water system in a fair way.

5.1.1: DIFFERING EXPECTATIONS BETWEEN ETAPA AND THE LANDOWNERS

One major challenge that ETAPA and the landowners face is a difference in expectations for the project. The landowners' livelihoods depend on water. This puts a sense of urgency on the landowners to find a solution to increase their access to water quickly. Even though ETAPA's goal is to help the communities they serve to the best of their abilities, ETAPA also faces limitations of their own. Design, funding, and support all take time and resources. This challenge is made even greater by the fact that ETAPA is working on multiple projects simultaneously.

A difference in expectations has led to a conflict between some of the landowners and ETAPA. As mentioned by Julia and Luis Benigno, landowners are not satisfied with ETAPA's actions thus far and want more 'seriousness' from ETAPA. One approach could be for ETAPA to dedicate more team members to working on the water system project, increasing the attention on the community. However, it would require increasing the time, money, and effort that ETAPA has to dedicate in Cochapamba Grande. Likewise, this would increase the staffing demand in the future as ETAPA wants to use this system as a model for other communities facing the same challenges in the future. ETAPA could also send various engineers to the community to do work so that the landowners can perceive more effort from ETAPA. Instead of always sending the same engineer, the engineer who visits the community can rotate so that the landowners work with a variety of ETAPA employees.

Another approach may be implementing an anonymous feedback system. This could have the benefit of improving the communication between the landowners and ETAPA. This system could work by having the landowners give their feedback to the elected secretary of the community, and then the secretary tells ETAPA. An improvement in communication can alleviate tensions that arise due to the landowners feeling unheard by ETAPA. However, if the feedback system is not utilized by ETAPA, it may lead to stronger feelings from the landowners of not being heard.

5.1.2: WATER CONTAMINATION

Our findings indicate that two of the landowners believe that water in the system is contaminated. As discussed in our interviews, water with less contamination is better for agriculture, therefore if ETAPA could reduce contamination, it would have positive impacts for the landowners. A filter for the water system could be an approach that increases the positive impacts for the landowners while reducing some of the challenges they still face.

One filtration approach is to retrofit a filter onto the water distribution system. A simple filtration method would be to add rocks and sand to the bottom of the tank (Figure 5.1). This simple filtration method removes contamination from the water while also not costing many resources. The downside to this method is that it would remove some storage volume of the tank.



Figure 5.1: Example of a Rock and Sand Filter

Another filtration option would be to add an individual filter to each landowner's capitation point. This would leave the volume of the tank the same while still giving filtration to the landowners. A downside to this approach would be that it is more expensive, and it would also require time for installation. After installation, each of the filters would have to be maintained, requiring time and manpower.

5.1.3: FAIRNESS IN THE ACCESS AND USE OF THE SYSTEM

As suggested by Luis Benigno's interview, one challenge that landowners face is the fair usage of the water system by everyone. Even though only one landowner suggested this, we investigated this further and as indicated in Figure 4.4; Luis Benigno was right, and our group found leaky capitation points. In order to minimize the negative impacts that could come from the misuse of the system, a water monitoring system such as meters could be installed. A monitoring system would help keep track of how much water each landowner is using. However, in order to have the system function properly, ETAPA would need to monitor it and set measurements and fines to deter over usage. One possible approach to this would be to organize a group of landowners to monitor gauges. This would empower the landowners and encourage independence. A downside to this would be that it could lead to tension between the landowners who enforce the limit and those surpassing the limit. Another approach would be to have a member of ETAPA monitor the gauges. This would take time and resources for ETAPA to carry out. This also could create a divide between ETAPA and the landowners if ETAPA enforces the limit.

5.2: FUTURE RESEARCH QUESTIONS

The aforementioned approaches to the challenges that stemmed from the impacts from the implementation system can be utilized by ETAPA in the community. Our research was inconclusive on several impacts that we identified, therefore we propose six questions to be investigated further:

1. How do soil composition and amount of rainfall affect pasture productivity?
2. How does landowner participation in a project affect their perceived increase in community collaboration in response to that project?
3. Does the distance from the water system affect agricultural production and if so, does this create a social impact by creating an unequal distribution of water for the landowners?
4. Does the improvement in access to water as well as the decrease in contamination affect the land value? Is this change equal to all properties?
5. Is there a difference in water contamination between the natural stream and the water system (perform scientific analysis)?
6. Does the farms' distance from the river affect the landowners' perception of increased access?

In order to learn more about the landowners, we recommend that at a meeting a member of ETAPA gathers background information from more landowners, not just the ones that we interviewed; the survey in Appendix D may be a helpful tool for gathering this information. With this information, ETAPA can be better informed with any decisions they make in Cochabamba Grande in the future.

5.3: CONCLUSION

The risk of cattle defecating and increasing the amount of sediment that enter natural waterways caused ETAPA to implement the agricultural water distribution system in Cochabamba Grande since the water is used for human consumption downstream. The goal of our project was to investigate the social and economic impacts of this water system in order to fulfill ETAPA's responsibility of aiding communities by protecting water sources. To complete this, our group interviewed landowners to discover what they perceived as impacts from the system. These impacts, outlined in Chapter 4 and the socioeconomic analysis (Appendix E), are on communal relationships, the relationship between ETAPA and the landowners, fair usage of the system, farm productivity, access to water, water contamination, and land value. These impacts affect how the landowners perceive and use the system which therefore affects ETAPA's goal of protecting water sources for human consumption. For future systems, ETAPA can better understand these impacts which could be transferable to other communities facing similar issues.

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APENDICIES

APPENDIX A: QUESTIONS ASKED DURING GUIDED TOUR WITH LANDOWNERS

- Is the water contaminated?
- How easy it is to use the system?
- What did you use before the system?
- Is the new system better or worse for your cattle and crops than what you did before?
- Is it easy to use the system?
- Do all landowners have access to the system?
- Are landowners limited to where they can use the system?
- What is more important your cows or crops?
- Do you sell everything?
- How much time does it take you to collect water?
- Does the system function well?
- Why do you not use the water from there?
- Is the system easier than the river?
- How much land do you have?
- Where is your water?
- Did you construct the tank for water?

APPENDIX B: QUESTIONS ASKED DURING GUIDED TOUR WITH ETAPA ENGINEER

- Where does the water come from?
- How do the farmers use the water?
- Where does the water go after the system?
- Is the water filtered?
- Is there enough water?
- What did the farmers do before hand?
- How many capitation points are there?
- Is the water potable?

APPENDIX C: INTERVIEW QUESTIONS

Family Information

- How many generation has this farm been in your family?
 - Why did you continue farming this land?
 - Did you want to do something else?
- Could you do something else?
- What do you hope for your children?
 - Would you want them to take over the farm?
 - Would you prefer they did something else?

Relationships in the Community

- How do the elected positions work?
- Does the elected president have any legal power?
 - What about social influence
- Is there competition among other landowners?
 - What causes this?
 - Has the addition of the system increase the competition?
- Are any of the other landowners a part of your family?
- Do you consider any of your neighbor's friends?
- Would you consider anyone in the community influential or a leader?
- What resources are shared with others in the community vs. what is strictly kept to the individual? (such as milk, water...)
- After ETAPA introduced the water system, did your views on any of the other landowners change?

ETAPA

- Do you know ETAPA's goal in this community?
- How is your relationship with ETAPA?
- Has your relationship changed after the implementation of the system?

Farming

- What factors do you consider before changing one of your farming practices?
 - Would your answer change depend on who the person was? For example, if we came to with a new practice vs. if Alejandro (president) told you about it?
- How much farmland do you have?
 - How much of that is for cattle grazing, other aspects too?
 - How much did that land cost? How much does it cost now?

- Does anyone else work on your farm with you?
 - When did they start working on the farm and why?
- What is produced on your farm? (beef, milk, crops?)
 - How much of each of these is produced?
 - Has what you produce changed since the implementation of the system?
 - What do you sell these for?
 - Do they sell for less because of the system and availability of water?
- How many animals are on your farm?
 - Have you been able to increase this number because of the water system?
 - Why do you have this many animals?
- How much time do you spend farming each day?
 - Has this changed because of the water system? How much time before the system did you spend farming?
- Were you able to use different parts of your land before the water system compared to after? Ex. if you centralize land use around the hose now compared to around the river
- Have you ever cleared out land to expand your farm?
 - How much land have you cleared to do this?
 - Have you cleared land since the implementation of the water system or have you been able to stop clearing land because of the system?
- What do you do with cow manure or other farm wastes?
 - What did you do before the system/fence was built?
- Do you use a fertilizer or pesticide on your land?
 - If so what, do you know what is in it?
- Does the grass recover fast enough for your cattle?
 - Does it recover faster now because of the water system?
- How often do you rotate your animals?
 - Has your rotation habit changed thanks to the water system?

The Current System

- How does it affect your daily life?
- Does it change how you use your daily time?
- How do you think the water distribution system affects the community?
- Is the system fair to all of the property owners? Why or why not?
 - Topics for Probing: is it affected by number of cows, amount of land... what do the landowners think is fair?
- How much did you as a property owner pay for the old system?
 - If you didn't pay, where did this money come from?
- How has it affected your profit?
- How has adjusting to the water distribution system worked?
- Are you aware of how to properly use and maintain the water distribution system?
- Does the system do everything you wanted it to?
 - Have you made any modifications to the system so that it works better for you?
 - Do you want to?

- Why?

Water Shortage in the Summer

- In what ways is life different in the summer and winter?
- Does the system change how you are able to farm in the summer?
- What is the benefit of farming year round?
- What is your source of income in the summer?
- Is farming more preferable?
- Does the lack of water in the summer keep you from expanding in the winter?
- If you expanded because of the new system, are you worried about losing this expansion in the next summer?
- Are the summer jobs more profitable than farming?
- Is milk/other products worth more in the summer due to the the dryness?

General Economics

- Does your household have any other source of income?
- Is your farm profitable?
 - If not, then why do it?
 - Could your farm become profitable?
 - If yes, how profitable?
 - Barely enough to get by or enough that you have some money saved up?
- Is profitability a priority to you?
- Does the system increase your profitability? In what way?

General Water Use info

- How much water do you use?
 - For each specific activity?
- Do you use more water now after the system was built?
- How do you get water for drinking?
- How much can you store at a time?
- Do you have easier access to water now with the system?
- Do you use any water besides that of the system for agriculture?
 - If yes, why do you not use the system
- What practice uses most of the water?

General Environmental

- How often do the parasites occur in your herd?
- What is the cause of the parasites?
- What do you do with the animal waste?
- Does the system affect the contamination of the water?
- Are you aware of any environmental regulations?
 - Have they affected you personally?

- Have you considered planting trees in the striped pattern? (show them the picture?)
 - Do you know the benefits of it?

New System

- Are you in favor of implementing a new pump system?
- What do you expect to get out of this new system?
 - How does this increase the amount of water in the area?
 - Why would the water be cleaner?
- Can you think of anything else that the system changed for you that we haven't gone over yet?
- Is there anything else you want to tell us about your farm or water usage that you feel is important for us to know?

APPENDIX D: SURVEY QUESTIONS ABOUT BASIC LANDOWNER DATA FOR ETAPA TO USE

1. How many pieces of land do you own?
2. How big are the pieces of land you own?
3. Where are your pieces of land located?
4. What type of crops/livestock do you have on your farm?
5. How many of each type of crop/livestock do you have?
6. How much water do you use daily for farming activities?
7. What is your main source of income?
8. Do you have other sources of income?

**APPENDIX E : SOCIOECONOMIC ANALYSIS
DELIVERABLE**

Impactos Grande y Pequeño

Un análisis socioeconómico para terratenientes del sistema de distribución de agua agrícola en la región de Cochabamba Grande, Quinego

Escrito para ETAPA como parte del Proyecto de Calificación Interdisciplinario en el Instituto Politécnico de Worcester (WPI). El propósito de este documento es un análisis socioeconómico a los propietarios de Cochabamba Grande desde la implementación del sistema de distribución de agua..

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Somos estudiantes que nos inscribimos en un programa de estudios WPI en el extranjero, comenzamos este proyecto el 10 de enero y finalizamos el 1 de marzo de 2019. Trabajamos extensamente con ETAPA y dentro de la comunidad durante este período de dos meses para realizar este análisis.

Tabla de Contenidos

Descripción General	3
Descripción General de los Impactos Percibidos Descritos en la Tabla 1	4
Introducción a Impactos Sociales	6
Pocos propietarios perciben impactos en la colaboración comunitaria	6
Una mayoría de los propietarios de tierras percibió la equidad en el uso del sistema	7
Introducción a los Impactos Económicos.	7
El impacto en la productividad de la granja no está claro	7
No está claro si el nivel de contaminación en el agua del ganado disminuyó	8
Algunos propietarios reclamaron un aumento en el valor de la tierra debido a que el sistema fue implementado	8
Limitaciones	9
Los desafíos y los posibles enfoques.	9
Desafíos	10
Diferentes expectativas entre ETAPA y los terratenientes	10
Contaminación del agua	11
Equidad en el Acceso y Uso del Sistema de Agua.	12
Preguntas de investigación futuras	12
Apéndices	14
Apéndice A: Perfils	14
Percepciones de Julia Maria Caivinagua Caivinagua sobre los impactos del sistema de agua	14
Percepciones de Luz Maria Hurtado Carreño sobre los impactos del sistema de agua	18
Percepciones de Luis Benigno Uyaguari Guartatanga sobre los impactos del sistema de agua	21
Percepciones de Luis Miguel Coraisaca Coraisaca sobre los impactos del sistema de agua	25
Percepciones de Segundo José Frias Frias sobre los impactos del sistema de agua	28
Apéndice B: Preguntas de la encuesta	31

Lista de Figuras y Tabla

Tabla 1: Síntesis Tabla de los Impactos Individuales del Sistema	5
Figura 1: Julia Maria Caivinagua Caivinagua, y Miembros del Grupo	14
Figura 2: Luz Maria Hurtado Carreño, su nieto, y Miembros del Grupo	18
Figura 3: Luis Benigno Uyaguari Guartatanga y Miembros del Grupo	21
Figura 4: Un punto de capitación con fugas	24
Figura 5: Luis Miguel Coraisaca Coraisaca y un Miembro del Grupo	25
Figura 6: Segundo José Frias Frias trabajando mientras era entrevistado por Miembros del Grupo	28
Figura 7: Tanque de agua utilizado por Segundo	29

Descripción General

Cuenca, Ecuador es única en el país por su agua potable de alta calidad. La calidad del agua se ve amenazada de múltiples maneras, incluso en la ganadería a pequeña escala. La entidad regional que gestiona los recursos hídricos, ETAPA, ha trabajado con los terratenientes para implementar un nuevo sistema para proporcionar agua al ganado con la intención de reducir la contaminación del agua del río proveniente de desechos orgánicos.

El objetivo de nuestro proyecto fue investigar los impactos sociales y económicos para los propietarios de tierras derivados de la implementación del sistema de distribución de agua para la agricultura en Cochapamba Grande. Para cumplir con esta meta, completamos tres objetivos:

- 1) Identificar los desafíos que enfrentan los propietarios de tierras en relación con el uso del agua
- 2) Obtener una comprensión del diseño y uso del sistema de agua
- 3) Investigar cómo el sistema de distribución de agua agrícola ha afectado las condiciones sociales y económicas de los terratenientes.

Para lograr objetivos, realizamos visitas guiadas al sistema, participamos en reuniones comunales y realizamos seis entrevistas con los propietarios de tierras.

De nuestro trabajo de campo, pudimos identificar una variedad de impactos que se detallan a continuación en la Tabla 1. Los impactos individuales se describen en el Apéndice A y están separados por cada propietario de la tierra. Después de esto, discutimos los impactos de todos los propietarios de tierras con los que hablamos y sacamos conclusiones de sus percepciones de los impactos. Con esto, hay conclusiones que no están claras basadas en los datos que recopilamos, por lo que creamos siete preguntas para futuras investigaciones. Además, nuestro grupo identificó tres desafíos en la comunidad que combinamos con posibles enfoques para que ETAPA los utilice.

Descripción General de los Impactos Percibidos Descritos en la Tabla 1

La siguiente tabla es una síntesis de los impactos individuales que se identificaron durante nuestras entrevistas con los terratenientes en Cochapamba Grande. También hicimos perfiles con más detalles sobre los impactos percibidos en cada propietario de tierra específico que se pueden encontrar en el Apéndice A. Cada impacto se clasifica en "Social" y "Económico" como se indica a la izquierda de la tabla. Además, los impactos se clasifican en "Procesos" o "Sistemas". "Proceso" se refiere a los impactos que surgieron debido al diseño e implementación del sistema. "Sistema" se refiere a los impactos que ocurren después de la implementación mientras se usa el sistema. La columna "Impacto" incluye todos los impactos que nuestro grupo identificó, que se explican más detalladamente en las siguientes secciones. La columna de la derecha indica cuántos y qué propietarios específicos percibieron los impactos. La tabla es el primer paso para sintetizar la información individual y observar los impactos globales que afectan a los múltiples propietarios de la comunidad. Después de esto, sacamos conclusiones e identificamos problemas, así como otras oportunidades de investigación en Cochapamba Grande.

Tabla 1: Síntesis Tabla de los Impactos Individuales del Sistema

<u>Categoría del Impacto</u>	<u>Subcategoría del Impacto</u>	<u>Impacto</u>	<u>Propietario</u>
Social	Proceso	Aumentado Relación con ETAPA	Julia
		Disminuido Relación con ETAPA	Julia
	Sistema	Aumentado Colaboración de la Comunidad	Segundo
			Julia
		Aumentado Equidad	Luis
			Segundo
			Julia
	Disminuido Equidad	Luis Benigno	
Económico	Proceso	Reglado fertilizante y semilla de césped hizo mejor césped	Julia
		Propietarios paga por el sistema	Maria
	Sistema	Aumentado access to water	Julia
			Rosa
		Aumentado productivity	Luis Benigno
			Maria
			Julia
		Propietarios paga dinero por el sistema mensual	Maria
		Percibido menos contaminación que el río	Julia
			Maria
		Aumentado valor de la tierra	Julia
	Maria		

Introducción a Impactos Sociales

Esta sección está diseñada para explorar cómo las percepciones individuales de los impactos de los propietarios encajan con las de otros propietarios que entrevistamos. Los impactos sociales son aquellos impactos que se relacionan con las relaciones entre los terratenientes y las percepciones de los terratenientes entre sí.

Pocos propietarios perciben impactos en la colaboración comunitaria

Tres de los cinco propietarios entrevistados no consideraron que el sistema de distribución de agua tuviera un impacto en las relaciones con la comunidad. Sin embargo, los otros dos terratenientes sintieron con mucha fuerza que el sistema de agua ha tenido un impacto positivo en las relaciones con la comunidad. Tanto Julia como Segundo pensaron que habían visto un aumento en la colaboración con otros miembros de la comunidad después de la implementación del sistema. Julia dijo que no se sentía apoyada antes del sistema de agua, mientras que ahora siente que la comunidad está unificada. Esta diferencia podría explicarse por la participación tanto de Julia como de Segundo en el proyecto. Julia es la secretaria electa del proyecto del sistema de agua, mientras que Segundo permite que las reuniones sobre el proyecto se realicen en su casa. Esto sugiere que cuanto más dispuestos estén los propietarios a participar en el proyecto, más percibirán y estarán dispuestos a participar en una mayor colaboración con otros propietarios. Adolfo y Luis, dos de los terratenientes que sentían que no había impactos en la colaboración comunitaria, estaban en las reuniones para el proyecto, sin embargo, no participaron. Luis Benigno y María, los otros dos terratenientes, no percibieron ningún impacto en la colaboración comunitaria y no estuvieron presentes en ninguna de las reuniones.

Dos de los cinco terratenientes percibieron impactos positivos derivados de una mayor colaboración comunitaria entre los terratenientes. La unificación de la comunidad de la que habló Julia se mostró cuando algunos de los terratenientes viajaron a las propiedades de los demás para ayudar a vacunar el ganado de otros terratenientes. Durante este proceso, los terratenientes más jóvenes y más fuertes fueron a varios pastizales, compartieron suministros de vacunación y ayudaron a atar vacas. Esta colaboración tuvo un impacto económico positivo en los terratenientes que participaron, ya que podían ayudar a compartir el costo de las vacunas y reforzaron las relaciones sociales positivas.

Una mayoría de los propietarios de tierras percibió la equidad en el uso del sistema

Tres de cada cinco terratenientes consideraron que el sistema era justo para todos los que usaban el sistema. Si bien María no estaba segura de la imparcialidad del sistema, el único terrateniente que sentía que el sistema no era justo era Luis Benigno. Luis Benigno creía que el sistema no era justo porque diferentes terratenientes usaban diferentes cantidades de agua. Su creencia de que el uso del sistema es injusto se vio reforzada cuando María declaró que le gusta dar agua a sus vacas tres o cuatro veces al día. María dijo que ella sabe que otros agricultores solo dan agua a su ganado una vez al día y esto puede afectar su producción de leche. Antes del sistema, María no podía haber dado agua a sus vacas tres o cuatro veces al día debido a su condición física, pero ahora puede hacerlo porque no tiene que caminar mucho para llevar su ganado a la fuente de agua. A sabiendas, María toma más agua que otros agricultores para aumentar su propia productividad. Esto se deriva del sistema, ya que el aumento potencial en la accesibilidad del agua puede permitir a los propietarios usar más que otros. A Luis Benigno también le preocupa que los terratenientes dejen los puntos de capitación abiertos por accidente. Esto desperdicia agua que podría ser utilizada por otros terratenientes.

Los otros terratenientes sintieron que el sistema era justo ya que todos tenían un punto de capitación. Sin embargo, durante las entrevistas, estos terratenientes nunca aludieron a diferentes terratenientes usando demasiada agua o dejando sus puntos de capitación abiertos, desperdiciando así el agua. A Luis Benigno le preocupa que, sin controlar la cantidad de agua que toman los propietarios, algunos propietarios tienen impactos negativos en otros en la comunidad.

Introducción a los Impactos Económicos.

Esta sección demuestra cómo el sistema de agua ha afectado la economía de los terratenientes. Los impactos económicos consisten en impactos relacionados con la productividad del propietario, el acceso al agua, la calidad del agua y el valor de la tierra.

El impacto en la productividad de la granja no está claro

No está claro si el sistema ha aumentado la productividad de los terratenientes en la comunidad. Tres de los propietarios consideraron que el sistema no afectó su producción, mientras que otros dos percibieron un impacto

positivo. Los dos terratenientes que se percibió un aumento en la producción de más pastos que crecen en sus granjas, lo que permite que el ganado u otro ganado como el cuy crezca más. Por ejemplo, Luis Benigno pudo sostener más ganado en general. Esto podría deberse a un aumento en el acceso de agua desde el sistema. Los propietarios de tierras que percibieron tener un mayor acceso al agua también percibieron un aumento en la productividad de la granja. Por ejemplo, María declaró en su entrevista que el sistema le ahorra tiempo y energía porque ya no tiene que caminar con su ganado hasta el río. Esto mejora su acceso al agua ya que antes estaba limitada por su condición física y no podía caminar para darle agua a su ganado tantas veces como ahora. Julia también se percibió por haber mejorado el acceso al agua.

Una observación de nuestras entrevistas es que los propietarios de tierras que experimentaron un mayor acceso al agua, así como un aumento en la producción de pasto y ganado, viven más cerca del tanque que aquellos que no han experimentado un aumento en la producción. Luis no percibió ningún cambio en su acceso al agua y se encuentra adyacente al río. También es importante señalar que ninguno de los propietarios de tierras dijo que el sistema de distribución de agua tuvo un impacto negativo en su producción total.

No está claro si el nivel de contaminación en el agua del ganado disminuyó

No está claro si el sistema les ha dado agua a los propietarios con contaminación reducida, ya que dos de los cinco propietarios no percibieron un impacto en el nivel de contaminación en el agua de su ganado. Uno de esos dos terratenientes, Luis, usó el agua del sistema para su ganado. Su ganado todavía termina enfermándose y no puede producir leche para el consumo humano. Luis atribuye esta enfermedad a ser de la contaminación en el agua. Sin embargo, Julia dijo que su ganado prefería el agua del sistema sobre el agua del arroyo. Ella cree que su ganado a veces no bebe el agua del arroyo porque está contaminada y además cree que el agua contaminada reduce la cantidad de leche que producen. Las acciones de los ganados de Julia le sugieren que el agua del nuevo sistema está menos contaminada.

Algunos propietarios reclamaron un aumento en el valor de la tierra debido a que el sistema fue implementado

Si bien dos terratenientes afirman que el sistema ha aumentado el valor de sus tierras, no hay pruebas suficientes para afirmar que todas las propiedades

aumentaron en valor de la tierra o cuánto cambian los valores. Julia compró su tierra en los últimos años y nos dijo que ahora podía vender su tierra por más dinero. María también exclamó la obviedad del hecho de que el valor de su tierra cambió debido al sistema, y agregó que el valor aumentó aún más con el agua y el fertilizante. Con un mayor acceso al agua para algunos terratenientes, percibieron que su valor de la tierra aumentaba. No todos los propietarios de tierras tienen un aumento en el acceso al agua, lo que, por lo tanto, podría afectar el cambio en el valor de sus tierras. Existen múltiples factores que pueden afectar el valor de la tierra y, con dos respuestas de mayor valor, no está claro si toda la comunidad se ve afectada de la misma manera o en la misma magnitud que Julia y María.

Limitaciones

Nuestro análisis estuvo limitado por cinco factores diferentes:

1. La barrera del idioma hizo difícil obtener toda la información que queríamos.
2. En las entrevistas, los terratenientes a veces no podían entender nuestras preguntas hasta que las repetíamos varias veces. Mirando sus respuestas en nuestras transcripciones, es obvio que no entendieron todas las preguntas.
 - a. El dialecto de los agricultores fue uno de los que incluso el fluido hispanohablante que nos ayudó a traducir no pudo entender completamente, lo que afectó las transcripciones de nuestras entrevistas. El dialecto de un terrateniente era demasiado fuerte para entenderlo y traducirlo al inglés.
3. La mitad de las entrevistas que programamos se cancelaron, lo que afectó el número de propietarios de tierras con los que hablamos en la comunidad.
4. Debido a la cultura y los horarios ocupados de los agricultores, cualquier técnica de entrevista que incluyó papel o dibujo no fue factible.
5. Debido a la barrera del idioma y nuestro tiempo limitado en la comunidad, el propósito y objetivo de nuestro proyecto no estaba claro para los propietarios.

Los desafíos y los posibles enfoques.

A través de visitas para entrevistas, Mingas, visitas guiadas y reuniones grupales, nuestro grupo pudo observar y aprender sobre los impactos del sistema de distribución de agua agrícola en Cochapamba Grande. Mediante

nuestras entrevistas y visitas guiadas, se hizo evidente que el sistema de agua tenía diversos impactos en los cinco propietarios de tierras que entrevistamos. Social y económicamente, los propietarios de tierras se vieron afectados de manera diferente según su ubicación, tamaño y distancia del sistema de agua. Estos impactos se incluyen en los desafíos y soluciones que hemos identificado para ETAPA.

Desafíos

De nuestro trabajo de campo, nuestro equipo ha identificado tres desafíos que ETAPA enfrenta en la comunidad. Estos desafíos son las diferentes expectativas entre ETAPA y los propietarios de tierras, la contaminación del agua en el sistema y cómo usar el sistema de manera justa.

Diferentes expectativas entre ETAPA y los terratenientes

Un desafío importante que enfrentan ETAPA y los propietarios de tierras es una diferencia en las expectativas para el proyecto. Los medios de subsistencia de los terratenientes dependen del agua. Esto puso un sentido de urgencia en los propietarios de tierras para encontrar una solución para aumentar su acceso al agua rápidamente. A pesar de que el objetivo de ETAPA era ayudar a las comunidades a las que sirven de la mejor manera posible, ETAPA también enfrenta sus propias limitaciones. El diseño, la financiación y el apoyo requieren tiempo y recursos. Este desafío se hizo aún mayor por el hecho de que ETAPA está trabajando en múltiples proyectos simultáneamente.

Una diferencia en las expectativas ha llevado a un conflicto entre algunos de los terratenientes y ETAPA. No hay una forma sencilla de abordar este desafío, ya que diferentes estrategias tienen sus pros y sus contras. Un enfoque podría ser que ETAPA dedique más miembros del equipo a trabajar en el sistema de agua. Esto aumentaría la atención que recibe la comunidad. Sin embargo, requeriría reducir los recursos que ETAPA tiene que dedicar a otros

lugares. Del mismo modo, esto aumentaría la demanda de personal en el futuro, ya que ETAPA quiere usar este sistema como modelo para otras comunidades que enfrentan los mismos desafíos en el futuro. ETAPA también podría enviar más ingenieros a la comunidad para hacer el trabajo para que los agricultores puedan verlos interactuar en su comunidad. En lugar de enviar siempre al mismo ingeniero, la persona que va a la comunidad puede rotar para que la comunidad vea una variedad de personas.

Otro enfoque puede ser la implementación de un sistema de retroalimentación anónima. Esto podría tener el beneficio de mejorar la comunicación entre los propietarios de tierras y ETAPA. Este sistema podría funcionar haciendo que los propietarios de las tierras den su opinión al secretario electo de la comunidad, y el secretario le dice a ETAPA. Una mejora en la comunicación puede aliviar cualquier tensión que surja debido a que los propietarios no se sienten escuchados por ETAPA. Sin embargo, si el sistema de retroalimentación no es utilizado por ETAPA, puede llevar a sentimientos más fuertes por parte de los propietarios de no ser escuchados por ETAPA.

Contaminación del agua

Nuestros hallazgos muestran que algunos terratenientes creen que el agua está todavía contaminada incluso después de la implementación del sistema de distribución de agua. Como discutimos en nuestras entrevistas, el agua con menos contaminación es mejor para la agricultura; por lo tanto, cualquier cosa que ETAPA pueda hacer para reducir la contaminación tendría un impacto positivo para los propietarios de tierras. Un filtro para el sistema de agua podría ser una solución para aumentar los impactos positivos del sistema de agua para los terratenientes al tiempo que reduce algunos de los desafíos que aún enfrentan.

Un enfoque de filtración es adaptar un filtro al sistema de distribución de agua. Un método de filtración simple sería agregar rocas y arena al fondo del tanque, como vimos durante una de nuestras Mingas. Este simple método de filtración eliminaría la contaminación del agua y, al mismo tiempo, no costaría

muchos recursos. La desventaja de este método es que eliminaría un poco de volumen de almacenamiento del tanque, que es muy valioso.

Otra opción de filtrado sería agregar un filtro individual al punto de capitación de cada terrateniente. Esto dejaría el volumen del tanque igual, mientras se sigue filtrando a todos los terratenientes. La desventaja de esta solución sería que es más costosa y también llevaría más tiempo instalarla. Después de la instalación, cada uno de los filtros tendría que mantenerse, tomando tiempo y mano de obra.

Equidad en el Acceso y Uso del Sistema de Agua.

Como lo sugirió la entrevista de Luis Benigno, uno de los desafíos que enfrentan los terratenientes es el uso justo del sistema de agua por parte de todos. Aunque solo uno de los cinco terratenientes sugirió esto, investigamos esto más a fondo y como se indica en la Figura 4 en el Apéndice A, Benigno tenía razón y nuestro grupo encontró puntos de capitación con fugas. Con el fin de minimizar los impactos negativos que podrían surgir del uso incorrecto del sistema, se podría instalar un sistema de monitoreo de agua, como medidores. Un sistema de monitoreo ayudaría a mantener un registro de cuánta agua está utilizando cada terrateniente. Sin embargo, para que el sistema funcione correctamente, ETAPA debería monitorearlo y establecer medidas y multas para evitar el uso excesivo. Una posible solución para esto sería organizar un grupo de propietarios para monitorear los indicadores. Esto daría poder a la comunidad y fomentaría la independencia. Una desventaja de esto sería que podría llevar a resentimientos en la comunidad y crear una división entre los terratenientes y los que hacen cumplir los límites. Otra solución sería que un miembro de ETAPA monitoree los medidores. Sin embargo, esto tomaría más tiempo y recursos para que ETAPA lo lleve a cabo. Esto también podría crear una brecha entre ETAPA y los propietarios si ETAPA hace cumplir los límites.

Preguntas de investigación futuras

ETAPA puede utilizar los enfoques mencionados para los desafíos que se derivan de los impactos del sistema de implementación en la comunidad. Nuestro equipo ha identificado siete preguntas para ser investigadas en el futuro:

1. ¿Cómo afectan la productividad del pasto las composiciones del suelo y la cantidad de lluvia?

2. ¿Cómo afecta la participación de los propietarios de tierras en un proyecto el aumento percibido en la colaboración comunitaria en respuesta a ese proyecto?
3. ¿La distancia al sistema de agua afecta la producción agrícola y, de ser así, crea un impacto social al crear una distribución desigual de agua en la comunidad basada en la ubicación de la granja?
4. ¿La mejora en el acceso al agua, así como la disminución de la contaminación, afectan el valor de la tierra?
5. ¿Existe una diferencia en la contaminación del agua entre la corriente natural y el sistema de agua (realizar análisis científicos)?
6. ¿La diferencia en la percepción de los impactos en el acceso de los propietarios al agua se debe a la distancia que su granja tiene del río que usaron antes?
7. ¿Hay un cambio en el valor de las propiedades después de la implementación del sistema y, de ser así, es este cambio igual a todas las propiedades?

Para obtener más información sobre los propietarios de tierras, recomendamos que en una reunión con los propietarios de tierras, un miembro de ETAPA recopile información de antecedentes de los propietarios de tierras de la comunidad, no solo de los entrevistados; La encuesta en el Apéndice B puede ser una herramienta útil para recopilar esta información. Con esta información, ETAPA puede estar mejor informada sobre cualquier decisión que tome en esta comunidad en el futuro.

Apéndices

Apéndice A: Perfiles

Percepciones de Julia Maria Caivinagua Caivinagua sobre los impactos del sistema de agua



Figura 1: Julia Maria Caivinagua Caivinagua, y Miembros del Grupo

Pedazos de tierra	3 (uno en Cochapamba, uno en Guzho, uno en otro lugar)
Tamaño	1,900m ²
Vacas	Sin especificar
Cuy	45
Pollos	12

Julia es una de las terratenientes del área que tiene un terreno que bordea el camino del sistema de distribución de agua que tiene 1,900 m² (20,451 pies²). Además de la tierra en Cochapamba Grande, también tiene otras dos parcelas donde cultiva más y tiene otros animales. Ella usa el pedazo de tierra de Cochapamba Grande para el ganado y para cosechar el pasto para alimentar a sus cuyes. Cuando se le preguntó cuántas parcelas de tierra posee, Julia dijo: “Tengo 3 parcelas de tierra. Tengo uno aquí, uno en Guzho y otro ... * Apunta hacia otra área que no está en Cochapamba Grande * ”. Luego, al hablar de dónde se encuentran su ganado y sus cultivos, dijo: “No tengo nada aquí, es solo un pasto para el ganado. Abajo en mi casa tengo cuyes, pollos. Tengo plantas, recién plantadas, manzanas, peras, moras. Lo que crío es más cuyes. Y en el centro tengo plantas frutales, manzanas, peras, etc. ”. Como un ingreso suplementario, su esposo trabaja mientras ella cultiva.

Julia percibió que el sistema de distribución de agua tenía impactos positivos y negativos en:

1. Su relación con ETAPA.
2. La producción en su granja.

El proceso de implementación de la distribución de agua en la agricultura tuvo impactos positivos y negativos en la relación de Julia con ETAPA. Cuando se le preguntó acerca de las mejoras en los pastos antes y después de la implementación del sistema, Julia habló sobre la entrada de ETAPA a su comunidad y su presentación a través de la entrega de semillas y fertilizantes a los propietarios. Julia dijo: “Sí, primero el ingeniero [ETAPA] nos dio semillas y fertilizantes para tirar. Así que con eso sembramos y fertilizamos. Nos hace un

pasto hermoso y podemos criar más animales ”. Recibir las semillas de ETAPA aumentó la relación entre Julia y ETAPA. Esto también tuvo un impacto económico positivo secundario para Julia al permitirle mejorar su pastura mediante el uso de las semillas y el fertilizante.

Además, los compromisos que tuvo que hacer ETAPA al diseñar el sistema tuvieron un impacto negativo en la relación entre Julia y ETAPA. Cuando se le preguntó cómo la implementación del sistema afectó la relación de Julia entre ella y ETAPA, dijo: "Creo que me gustaría que el ingeniero fuera un poco más serio. Por eso le digo al ingeniero que tiene que pensar en ambos lados, porque trabajamos y ellos descansan. ¿Se vienen lavando las manos y, beben el agua? No lo creo ”. Julia cree que ella y los demás terratenientes no fueron escuchados cuando se diseñó e implementó el sistema. La cita muestra que Julia siente que los ingenieros de ETAPA están desconectados de la comunidad a la que sirven y no comprenden completamente las realidades de su sustento.

Segundo, el sistema de distribución de agua implementado ha tenido impactos económicos positivos para Julia al aumentar la producción de su granja. Julia siente que el sistema de distribución de agua permite una producción de leche más consistente de sus vacas. Cuando se le preguntó acerca de esto, Julia dijo: "A veces el ganado no quiere tomar el agua sucia [se refiere al agua en el arroyo]. Por otro lado, si se trae del nuevo sistema, se mejora lo suficiente y el ganado lo toma [refiriéndose al agua del sistema] con calma ". Asegurar que las vacas beban el agua del sistema significa que producirán más Leche ya que están mejor hidratadas. Una producción de leche más estable da entonces un flujo más estable de ingresos de las prácticas agrícolas de Julia.

Aunque el sistema de agua tiene algunos impactos económicos positivos para Julia, el sistema no tiene ningún impacto económico para sus otras áreas de tierra. Cuando se le preguntó cuántas parcelas posee, Julia dijo que solo tiene ganado y pastos en Cochabamba, mientras que ella tiene cultivos y otro ganado en sus otras granjas. Cuando habló sobre las diferencias en sus tierras de cultivo, Julia declaró: "la ayuda fue para aquí [en referencia al sistema de agua] y mi producción está en otra parte". Luego continuó diciendo que estaba pensando en mover más de sus cultivos y Ganado hasta Cochapamba Grande. Sin embargo, esto tendría un impacto negativo en Julia, ya que tomaría tiempo y recursos para mover su ganado y cultivos a esta parcela de tierra. Tampoco está claro si tomar la decisión de mudarse a Cochabamba Grande tendría un impacto económico positivo para Julia. Durante la entrevista, cuando se hablaba de la tierra, Julia dijo: “El pedazo de tierra

que tengo es muy pequeño. Creo que tiene 17 [metros] de ancho por 80 [metros] de largo. Abajo, en el centro tengo más. Y en mi casa es normal ”. Cuando se usa la palabra regular, Julia se refiere al hecho de que su tierra cerca de su casa es más plana y más fácil de cultivar que su tierra en Cochapamba Grande. Esto también podría crear un impacto en la comunidad, ya que Julia requeriría más agua del sistema.

Julia declaró que el sistema de distribución de agua implementado solo ha tenido impactos positivos en:

1. Sus relaciones con la comunidad
2. El valor de su tierra.

Primero, Julia siente que la introducción del sistema de agua ha tenido un impacto positivo en su colaboración y relación con la comunidad. Mientras hablaba sobre su trabajo, Julia habló sobre cómo se vio obligada a dejar de cultivar debido a lesiones personales. Más adelante en la entrevista, le preguntaron a Julia si pensaba que el sistema de distribución de agua afectaba la forma en que interactúa con la comunidad. Julia dijo: “Me retiré porque nadie me apoyó. Ahora estamos unidos, esperamos que continuemos así ”. Julia cree que el impacto que el sistema de distribución de agua ha tenido en ella es significativo, ya que le permite continuar con la agricultura. Eso no solo tiene un impacto positivo en las relaciones con la comunidad para Julia, sino que también tiene un impacto económico positivo porque ahora puede cultivar nuevamente y generar un ingreso.

Finalmente, Julia afirma que el sistema de distribución de agua ha tenido un impacto económico positivo al aumentar el valor de su tierra. Cuando se le preguntó sobre el valor de su tierra, ella reveló: “Tengo mi casa evaluada por \$ 22,000. Y ahora la tierra que me acabo de comprar me costó \$ 15,000. De aquí, no sé, 4 o 5 mil dólares”. Luego, a Julia le preguntaron si creía que el sistema de distribución de agua afectaba el valor de su tierra. Julia dijo: "Sí, con el derecho al agua podemos cobrar más porque tenemos la opción de recoger y traer [agua] al ganado, no tienen que bajar al agua". Julia percibe que ahora puede vender su tierra por un valor más alto debido al mayor acceso al agua en la propiedad.

Percepciones de Luz Maria Hurtado Carreño sobre los impactos del sistema de agua



Figura 2: Luz Maria Hurtado Carreño, su Nieto, y Miembros del Grupo

Pedazos de tierra	1
Tamaño	19,200 m ²
Vacas	5
Pollos	20
Cuy	20
Corderos	no especificado
Productos	Queso para \$1.25/lb

María es un terrateniente en la región con una propiedad de 19,200 m² (206,667 ft²). Su casa y su granja están ubicadas en el extremo opuesto de la fuente de agua natural en comparación con los otros propietarios. María ha estado cultivando en esta tierra durante 25 años con su esposo. Ella usa la tierra para cultivar cinco vacas, 20 cobayas y 20 pollos. Ella produce queso con la leche de sus vacas, que vende en una panadería cercana.

María percibió tres impactos positivos que surgieron de la implementación y el uso del sistema en

1. La contaminación del agua.
2. Su acceso al agua
3. Su valor de la propiedad.

Primero, María experimentó un impacto positivo en el nivel de contaminación en el agua debido al sistema. Ella dijo que debido al tanque y su tubería, el sistema evita que la "basura animal" contamine el agua. María se refiere a las heces de las vacas que se alineaban en el lecho del río ante el sistema, que ahora ya no son pisoteadas en la escorrentía como lo estaban antes.

En segundo lugar, María encontró un impacto positivo en su acceso al agua porque en el sistema hay más agua disponible que en el río. María notó que su manguera está siempre llena y que cuando se abre el punto de capitación, el agua sale con una fuerza fuerte, lo que demuestra que está satisfecha con su acceso al agua. También puede usar su agua para dar a su ganado tres o cuatro veces al día, en comparación con los otros terratenientes que solo dan agua a su ganado una vez

al día. Ella declaró que solía tener que caminar con las vacas al río para darles agua, pero ahora les da agua para beber desde el punto de capitación. Ella dijo: "Conseguir agua era algo difícil. Tomó trabajo. Ahora, con el sistema, no es difícil. Ya no voy caminando al arroyo con los animales". Este aumento en el acceso la ha beneficiado ya que solía caer en su camino para dar agua a las vacas, limitando la cantidad de agua que bebía el ganado.

En tercer lugar, María notó un impacto positivo del sistema en el valor de su propiedad. Cuando se le preguntó si había un cambio en el valor de su tierra, ella exclamó: "Bueno, por supuesto que hay un cambio". Ella vio que un acceso más fácil al agua hacía que su tierra fuera más valiosa.

El impacto negativo que María notó debido al sistema fue

1. El costo monetario y mensual del uso del sistema.

Un impacto negativo en María debido al sistema es el costo monetario para que ella acceda al sistema. María notó que había un cargo inicial para que ella pudiera usar el sistema de \$ 150. Además, mencionó otro cargo mensual que describió como: "Tengo que pagarle [al ingeniero de ETAPA] el dinero para que me permita asistir a las reuniones". De nuestras reuniones con otros miembros de la comunidad, hemos recopilado que este el costo es realmente por el uso continuo del sistema, su tono en la cita expresó sus sentimientos negativos hacia los pagos.

María también notó ningún impacto del sistema en

1. Sus interacciones con la comunidad.

A través de su no asistencia a las reuniones, María no ha visto un cambio en su interacción con los terratenientes de la comunidad. Como dijo María, ella es vieja y, por lo tanto, no asiste a actividades como reuniones o Mingas. Cuando se le preguntó si pensaba que ella interactuaba más con otros miembros de la comunidad, descartó la pregunta diciendo que todos son vecinos y se conocen entre sí. Esto se conecta con un impacto económico porque, como se demuestra en la forma en que los propietarios se ayudan entre sí con las vacunas para vacas, el trabajo joven se comparte con los propietarios que lo necesitan. María declaró que paga el trabajo físico que necesita en lugar de colaborar con otros miembros de la comunidad, lo que tiene un impacto negativo en sus ingresos. Si María participara más en la comunidad y en el proyecto del sistema de agua, podría colaborar más

con otros terratenientes y no tendría que pagar este gasto de mano de obra joven contratada.

Percepciones de Luis Benigno Uyaguari Guartatanga sobre los impactos del sistema de agua



Figura 3: Luis Benigno Uyaguari Guartatanga y Miembros del Grupo

Pedazos de tierra	3
Tamaño	2000 m ² , 3000 m ² , 3000 m ²
Cuy	200
Productos	Cuy, Maíz, Frijoles, Papas
Uso del sistema	Riega su pasto para comida de Cuy.
Tiempo dedicado a la agricultura	4 horas, todos los días
Otro ingreso	Carpintería y su tienda

Luis Benigno Uyaguari Guartatanga es un terrateniente con una propiedad de 2,400 m² (25,833 ft²) a lo largo del camino del sistema de agua y otros dos en la comunidad. Su casa está ubicada cerca del sistema en la cima de la colina con vista al tanque de agua. En su casa, cultiva cultivos como el maíz, los frijoles y la papa que utiliza para alimentar a su familia de seis. En su parcela de tierra en Cochapamba Grande, él cultiva pasto para alimentar a sus cuyes. Vende estos cuyes como fuente de ingresos. Como una fuente de ingresos de respaldo, tiene un negocio de carpintería y una pequeña tienda de conveniencia que administra al lado de su casa.

Si bien Luis Benigno declaró que no hubo impacto, a través de su descripción de otros impactos del sistema, Luis Benigno describió un impacto en:

1. Su acceso al agua.
2. Su economía personal

Primero, declaró que su acceso al agua no cambió debido al sistema de agua. A medida que hacíamos más preguntas, procedió a decir que el sistema le permitía cultivar más hierba que antes, lo que contradecía su afirmación anterior e indicaba un impacto económico positivo. Afirmó que este aumento en la producción de pasto llevó a más cuyes que eran más grandes cuando dijo: “Sí, y son más grandes. Si hay más comida, podemos tener más ...” Tener más y más grandes cuyes le permite a Luis Benigno vender más, posiblemente a un precio más alto debido al mayor tamaño.

En segundo lugar, siente que el sistema de agua no ha tenido ningún impacto en sus condiciones económicas personales porque el nuevo sistema no ha resuelto completamente el problema que enfrenta con la falta de acceso al agua. Continúa diciendo que hay períodos de escasez de agua durante los meses de verano, cuando el sistema y el río se secan, pero al convertirse en carpintero, mantiene un ingreso estable. Sin embargo, la falta de agua en el sistema tiene un impacto económico negativo en Luis Benigno, ya que no tiene suficiente agua para cultivar alimentos para su familia durante este tiempo, lo que lo obliga a comprarlos. A pesar de que manifestó esto, describió que era más fácil para él regar su pasto, lo que le daba acceso a más hierba para alimentar a su conejillo de indias y, a su vez, podía cultivar más conejillo de indias, lo que le permitiría vender más y más. hacer mas dinero.

Luis Benigno no percibió el impacto suficiente de la implementación y el uso del sistema en:

1. La contaminación del agua.

Luis Benigno dijo que no cree que el nuevo sistema de distribución de agua haya tenido un impacto en la contaminación del agua. Cuando se le preguntó si el agua en el nuevo sistema tenía menos contaminación, Benigno afirmó que la única diferencia entre el sistema y el río que se usaba antes era que el ganado ya no pisotearía el taburete junto al río. Si bien esto elimina la contaminación del agua, Luis Benigno desconoce el daño que la defecación del ganado cuando está en los ríos o cerca de ellos, o bien no percibe que el cambio haya disminuido la contaminación.

Luis Benigno también expresó sus puntos de vista sobre dos impactos importantes durante la entrevista que resaltan los impactos sociales de la introducción del sistema de agua:

1. Cree que los terratenientes abusan del sistema de agua al no cerrar sus puntos de capitación
2. La relación entre los terratenientes y ETAPA no ha mejorado.

Primero, él tiene la sospecha de que los otros terratenientes están abusando del uso del sistema al no cerrar sus puntos de capitación, desperdiciando así el agua del sistema. Benigno dijo: "Hay muchas personas que abren la llave y se olvidan

[de cerrarla], y luego se desperdicia el agua". Esto conduce a una fuga constante de agua (Figura 4) del sistema que luego deja menos agua para los demás terratenientes. Su sospecha de los comportamientos de otros sugiere cómo se relacionan los impactos sociales y económicos; él cree que otros están desperdiciando agua, lo que afecta la disponibilidad de agua en períodos más secos, lo que luego afecta la productividad de su granja.



Figura 4: Un punto de capitación con fugas

En segundo lugar, Luis Benigno no sintió que el sistema impactara positivamente la relación de los propietarios con ETAPA. Tenía una perspectiva negativa de cómo los otros terratenientes vieron la implementación del sistema diciendo: "Hicieron algo de trabajo para nosotros, así que deberíamos estar agradecidos". Luis Benigno está feliz de que ETAPA esté ayudando a los terratenientes mientras muestra una decepción en los demás terratenientes queriendo más de ETAPA en lugar de parar para agradecerles la ayuda que ya habían brindado.

Percepciones de Luis Miguel Coraisaca Coraisaca sobre los impactos del sistema de agua



Figura 5: Luis Miguel Coraisaca Coraisaca y un Miembro del Grupo

Pedazos de tierra	1
Tamaño	6,300 m ²
Vacas	16
Productos	Leche, Carne, Maíz, Frijoles
Tiempo dedicado a la agricultura	Todo el día, todos los días
Otro ingreso	Su tienda

Luis Miguel Coraisaca Coraisaca posee una propiedad a lo largo del sistema de distribución de agua que es de aproximadamente 6,300 m² (67,813 pies²). Recientemente se mudó a su casa actual en la cima de la colina que domina su granja y actualmente está endeudado con el banco por comprar la casa. Tiene 16 ganados y su principal fuente de ingresos es la venta de la leche que produce su ganado. También cultiva maíz y frijoles en su tierra y solía tener chivos, ovejas y cerdos en su granja antes de que fueran robados.

Luis declaró que el sistema de agua no produce suficiente impacto en

1. La contaminación del agua.
2. La cantidad de agua que puede usar para su granja.

Primero, afirmó que si el agua en el sistema de distribución estaba más limpia, entonces no tendría que gastar tiempo y dinero en vacunar a su ganado cada tres meses. Luis vacuna su ganado para evitar que su ganado se enferme por lo que cree que es el agua que todavía está contaminada. La vacunación de su ganado contamina la leche del ganado durante dos días, por lo que no puede vender su leche durante ese tiempo. Cuando las vacunas no son suficientes y el ganado se enferma, Luis tiene que cambiar este ganado por otros nuevos entre \$ 100 y \$ 150. Luis también dijo que evita comprar mejor ganado lechero debido a la posibilidad de enfermarse. Por lo tanto, Luis siente que la falta de agua limpia en el sistema está impidiendo que Luis mejore su rebaño para un ingreso más alto.

En segundo lugar, afirmó que el sistema de distribución de agua no proporciona suficiente agua para su pasto. Le preocupa la cantidad de hierba que

puede crecer en su tierra debido a la cantidad de agua provista por el sistema. La falta de crecimiento de la hierba significa que el ganado crece a un tamaño más pequeño. Cuando se vende, el ganado más pequeño se vende por menos, por lo tanto, menos ingresos o él debe vender más ganado para compensar los gastos repentinos. Menos tierra de pastos también limita la cantidad de leche que produce el ganado, lo que deja a Luis con menos ingresos de los deseados.

Percepciones de Segundo José Frias Frias sobre los impactos del sistema de agua



Figura 6: Segundo José Frias Frias trabajando mientras era entrevistado por Miembros del Grupo

Pedazos de tierra	1
Tamaño	11,300 m ²
Vacas	5
Cuy	150 (\$10-\$12)
Cerdos	11
Corderos	6
Pollo	no especificado
Productos	Leche, Carne, Verduras,
Tiempo dedicado a la agricultura	12 horas, todos los días

Segundo es un propietario de tierras que posee propiedades en el área del sistema de distribución de agua. Su propiedad es de 11,300 m² (121,632 pies²) y está cerca de la carretera en la cima de la colina. Él es dueño de la última propiedad que la tubería del sistema alcanza pero no usa el sistema porque tiene su propio tanque de agua que está ubicado más cerca. Utiliza este otro sistema para regar sus cultivos, pastos y ganado, así como para cocinar su comida (Figura 7). El ganado en su granja incluye vacas, pollos, ovejas y cobayas.



Figura 7: Tanque de agua utilizado por Segundo

Segundo explica que el sistema de agua ha tenido un impacto positivo en

1. Su interacción social dentro de la comunidad.

Aunque Segundo no usa el sistema de agua, él lo percibe como un impacto positivo en sus interacciones sociales dentro de la comunidad. Afirmó que apoya a los otros propietarios de tierras que usan el sistema, como lo demuestra su presencia en las reuniones sobre el sistema. Además, esto se demuestra al permitir reuniones y dos de nuestras entrevistas en su propiedad. Segundo dijo: "Me gusta apoyarlos. Porque así es como debería ser". Segundo apoya a otros miembros de la comunidad, lo que, por lo tanto, lo afecta positivamente, al igual que otros terratenientes lo apoyan también.

Apéndice B: Preguntas de la encuesta

Preguntas de la encuesta para datos básicos de propietarios de tierras para uso de ETAPA

1. ¿Cuántos terrenos tienes?

2. ¿Qué tan grandes son los pedazos de tierra que tienes?

3. ¿Dónde están ubicados tus pedazos de tierra?

4. ¿Qué tipo de plantas / animales tienes en tu granja?

5. ¿Cuántos de cada tipo de planta / animal tienes?

6. ¿Cuánta agua usas diariamente para las actividades agrícolas?

7. ¿Cuál es tu principal fuente de ingresos?

8. ¿Tienes otras fuentes de ingresos?