La Campaña de Mañana:

Promoting awareness of threats to the water supply in Quingeo, Ecuador

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La Campaña de Mañana: Promoting awareness of threats to the water supply in Quingeo, Ecuador

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I. Abstract

Our project supported the work of the Empresa Pública Municipal de Telecomunicaciones, Agua Potable, Alcantarillado, y Saneamiento de Cuenca (ETAPA-EP) to protect water sources in Quingeo, Ecuador. We designed a set of strategies to promote awareness among three groups in Quingeo about the impacts of common cattle ranching practices on the water supply. We conducted interviews and collected survey data from two different communities to understand the audiences' perceptions of these practices. The data revealed that community members are unaware of the factors that promote harmful ranching practices and of better alternatives. We proposed and tested community outreach activities and provided recommendations to ETAPA about how to continue promoting awareness in Quingeo.

II. Acknowledgments

We would like to thank everyone that helped us succeed in our project work. This work would not have been possible without the support of our sponsor, ETAPA-EP, and the people we worked with, including Marco Bustamante, Pedro Martinez, and Galo Carrion. We would also like to thank Rodrigo Rosendo Morales Gomez, the president of Quingeo; Carmita and the schoolchildren from Punta Hacienda; Diva and the schoolchildren from Cochapamba Grande; the ranchers we worked with during mingas; and the community leaders we talked to in workshops.

We would also like to thank our advisors, Professors Seth Tuler and Robert Hersh, for their guidance and feedback as our project progressed, as well as our reference librarian, Philip Waterman, for helping us during the research phase of the project.

III. Authorship

CHAPTER/SECTION	PRIMARY AUTHOR(S)	PRIMARY EDITOR(S)
ABSTRACT	Turcotte	McQuade
EXECUTIVE SUMMARY	-	-
INTRODUCTION	ALL	ALL
BACKGROUND	ALL	ALL
METHODS	ALL	ALL
FINDINGS	ALL	ALL
RECOMMENDATIONS	ALL	ALL
CONCLUSIONS	Turcotte	Lopez

The contents of each chapter labeled with “All” as both Authors and Editors means that the chapters were divided into sections between the authors and drafted, followed by combining the drafts and editing the sections together.

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1 Introduction

A view of farmland in Quingeo, Ecuador.

Photo by Timothy McQuade

1.0 Introduction

In 2015, an estimated 844 million people lacked a basic drinking water service (UNICEF, 2017). Lack of access to clean water is associated with multiple health, social, and economic problems. For example, the most vulnerable populations suffer from water-borne bacterial illnesses, and many die (UNICEF, 2017). Additionally, populations without access to clean water struggle to achieve socio-economic development, as communities rely on water for agriculture and industry use (Zhou, Deng & Wu, 2017). Although access to clean drinking water has increased significantly over the past few decades due to improved technology and infrastructure**,** many regions still face threats to their clean water supplies (UNICEF, 2017).

Despite being dubbed the "Water Capital of the World" by the Pan-American Health Organization (PAHO), Ecuador faces risks to its water supply. While up from 50 percent in 2000, rural access to clean water in Ecuador increased only to 56 percent by 2015 (UNICEF, 2015). In addition, poor farming practices continue to threaten the quality and quantity of water available in Ecuador. Pollution of rivers with pesticides contributes persistently to water-borne illnesses in farming regions in Ecuador (Kintto, 1999). Clearing trees for fertile land and soil leads to deforestation at estimated rates of 200 to 300 hectares per year, which diminishes water recharge zones and decreases the land's capacity to hold water (Buckalew, James, Scott & Reed, 1998).

Given the threats to water quality and quantity in Ecuador, one way to address these threats is to shift human attitudes and behaviors. Researchers have investigated awareness campaigns, or comprehensive efforts to reach a specific goal using multiple means of communication (Bouder, 2013). For example, UNICEF Ecuador launched an awareness campaign in Guayaquil to raise awareness about Zika Virus in Ecuador (UNICEF, 2019). In their campaign design, UNICEF identified pregnant women as their target audience, developed messages about getting vaccinated to protect newborns, and communicated these messages through radio, promotional videos, and endorsement from political and cultural figures (UNICEF, 2019). Implementing change requires overcoming economic, social, and legal obstacles. Awareness campaigns are useful because they create opportunities for change through promoting awareness of these obstacles and suggesting ways to address them (REACH, 2015).

The concept of an awareness campaign has appealed to the Empresa Pública Municipal de Telecomunicaciones, Agua Potable, Alcantarillado y Saneamiento, Subgerencia de Gestión Ambiental (ETAPA). ETAPA manages and protect water sources in recharge zones across the Cuenca Canton in southeastern Ecuador (ETAPA, 2018). Although ETAPA's work with communities has helped to protect water sources, there are still communities that face threats to their water supplies; they are particularly concerned about Quingeo, one of the poorest and driest parishes in the Cuenca Canton that faces threats to its water supply from cattle ranching practices. ETAPA has introduced programs such as *Agua para todos* and *Agua vida* to educate community members about the impacts of ranching practices on the water supply (ETAPA, 2018). However, ETAPA does not yet have a complete picture of the factors that influence poor ranching practices and the community's beliefs surrounding the practices.

Our project goal was to design a strategy to raise awareness about the impacts of cattle ranching activities on the water supply for human consumption in Quingeo. To achieve this goal, we worked with ETAPA to identify the underlying causes of these ranching practices in Quingeo and characterize the community's attitudes and beliefs towards the threats these practices posed. Using this information, we proposed and tested community outreach programs to promote awareness of threats to the water supply and provided recommendations and educational materials to ETAPA. These materials and activities comprise an awareness strategy that ETAPA can use to continue their work in Quingeo.

2 Background

A cow tied to a post in El Verde, Quingeo.

Photo by Timothy McQuade

2.0 Background

In this chapter, we investigated the types of problems in Quingeo and how these problems create economic, social, and legal pressures that influence poor ranching practices in Quingeo. We then examined threats to the water supply that arise from these practices and identified potential methods to mitigate these threats. Finally, we investigated obstacles that make it difficult to implement these mitigation methods, and how a campaign can create opportunities for change by promoting awareness of these obstacles.

2.1 Problem Context in Quingeo, Ecuador

Quingeo is a parish located in the southeast region of the Cuenca canton that is home to roughly 7,500 inhabitants (Figure 2.1). Quingeo covers about 12,000 hectares that is distributed across 28 communities (GAD Parroquial de Quingeo, 2015). There are 21 schools in Quingeo, including a new millennium school that aims to provide better opportunities for students in rural communities ("Correa's Curriculum", 2009). The primary economic activities in Quingeo are agriculture and cattle ranching; these activities make up 42% of the Población Económicamente Activa, or the Economically Active Population (GAD Parroquial de Quingeo, 2015).

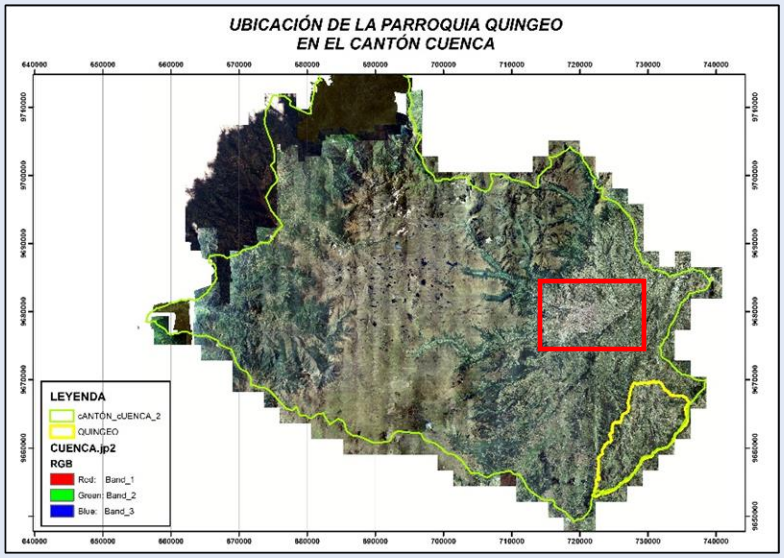

Figure 2.1: The yellow border in the bottom right shows the Quingeo parish. The red box shows Cuenca, the capital of the canton (ETAPA, 2018).

There are three factors that create economic, legal, and social pressures on ranchers. First, agrarian reforms in the 1960s and 1970s led to a breakdown of the hacienda (large estate) properties into smaller portions of land that were divided among working-class families (Clark & Becker, 2007). Undocumented and unequal land divisions have fueled conflicts over property rights and fostered sentiments of isolation and self-preservation in highland communities (Clark et al., 2007).

Second, Quingeo is one of the driest parishes in the Cuenca canton; it receives approximately 700 millimeters of rainfall per year, compared to 860 millimeters in Cuenca (ETAPA, 2018). The deterioration of the natural forest that currently covers 32% of Quingeo also decreases the capacity of the land to hold rainwater (GAD Parroquial de Quingeo, 2015).

Third, soil conditions for growing grass and crops have deteriorated in the region, leaving only 1.1% of the total land suitable for cultivation, and 4.5% suitable for pasture (GAD Parroquial de Quingeo, 2015). Figure 2.2 shows the distribution of soil conditions across the region; much of Quingeo's soil is under government regulation for regeneration.

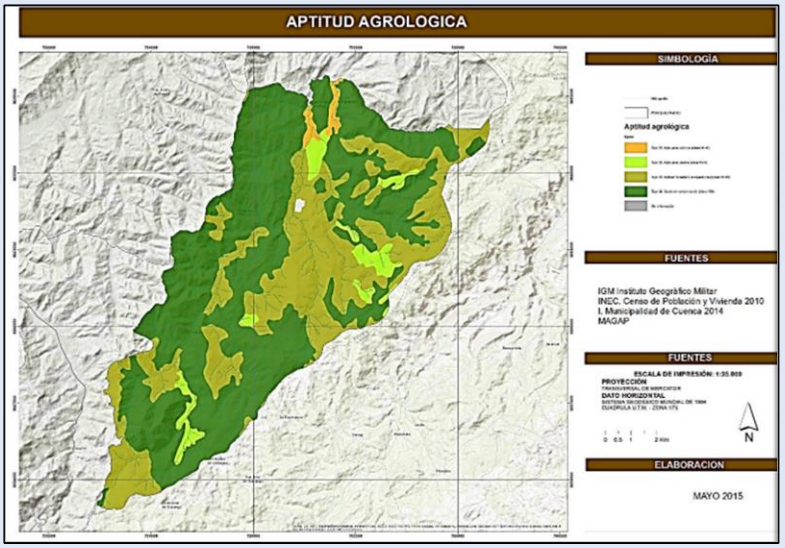

Figure 2.2: 62% of Quingeo's soil, labeled in dark green, is under strict legal conservation to protect it from further use (GAD Parroquial de Quingeo, 2015).

2.2 Poor Ranching Practices and their Threats to Water in Quingeo

The three pressures related to land reform, lack of rainfall, and poor soil quality have led to Quingeo ranchers implementing poor ranching practices which have negative impacts on the quality and quantity of water available in Quingeo.

First, poor pasture management leads to a series of dynamics that degrade pastures which decrease their capacity to hold water. Land divisions that created small, isolated pastures lead ranchers in Quingeo to tie their cattle to short leashes. The ranchers leave them in the pasture to graze, often for a day or longer, which leads to overgrazing. Overgrazing depletes the pasture of its nutrients and slows pasture regeneration rates. Many ranchers also face economic pressures that cause them to add more cattle to their herd. In theory, this would increase revenue, but instead intensifies the negative effects of overgrazing, as more cattle graze in the same amount of pasture. Additionally, many pastures become overgrazed because of low rainfall, pressuring the ranchers to let their cattle graze on pastures that are not fully regenerated. Overgrazed pastures cannot effectively filter agricultural runoff, the leading source of impairment to rivers and lakes (EPA, 2005).

Second, clearing land for more pasture decreases the land's total biomass, which decreases the amount of water the land can retain. Small and infertile pastures caused by land divisions lead ranchers to search for more grazing pasture for their cattle. Figure 2.4 shows the visible difference between the forested and deforested areas in Cochapamba Grande, Quingeo. The land's decreased capacity to hold water from deforestation results in warmer and drier conditions, leading to decreased rainfall in the region (Lawrence & Vandecar, 2015).

Third, neglecting to spread or pick up cow patties contributes to contamination of water sources from runoff. Cow manure can be composted along with straw and used in pastures which can benefit crops and soil (Augustin & Rahman, 2010). However, if these patties are left unmanaged, they harden and do not degrade easily due to dry soil conditions. Dried patties often sit in the field and are never spread or picked up which kills the grass underneath and makes it unsuitable for grazing. Furthermore, when it does rain, manure particles can get washed into water sources, which increases the levels of phosphorus within the water system. Phosphorous pulls calcium out of human or animal bones and creates unsafe deposits in blood vessels when ingested (National Kidney Foundation, 2017).

Figure 2.3: Cattle grazing in a pasture in Quingeo. The bottom right shows an area of grass that has suffocated due to overgrazing.

Figure 2.4: A view of a farming region in Cochapamba Grande, Quingeo. The top left shows a region that has been deforested for pasture.

Figure 2.5: Cow patties left in the fields of Quingeo that trample the grass underneath.

2.3 Methods to Mitigate Threats to Water Supply in Quingeo

There are three potential strategies to mitigate these threats to the water supply in Quingeo.

First, managing riparian zones, or interfaces between land and sources of water, increases water retention in vegetation (Lankester, Valentine & Cottrell, 2009). Riparian zones host hydrophilic plant communities that border the water source and absorb nutrients from the land. Increasing the density and diversity of a riparian zone, for example, by replanting native vegetation, can help land retain water over time while also protecting it from free-flowing pollutants. Farmers in Burdekin, Queensland have utilized riparian management practices (RRMPs) to improve production on their land (Lankester et al., 2009).

Second, farmers can plant trees in pastures to increase water retention in soil (Williams, 2018). One dairy farmer in Longnor, England planted trees to help shield soil from the wind and sun which can dry out soil and decrease its capacity to retain water (Williams, 2018). Furthermore, trees can be planted strategically to maximize benefits to soil. Figure 2.7 shows how ranchers in Quingeo planted trees perpendicular to the sun's rays to maximize soil protection.

Third, enclosing water sources with fences, thick vegetation, or both has proven effective to protect water sources from cattle and pesticide runoff (Worley, 2015). Externally financed initiatives in the Burdekin rangelands led to implementing 1100 miles of riparian fencing and 400 miles of sub divisional fencing to regulate grazing (Shepherd, 2005). Fences must be maintained to be effective; otherwise, cows and other livestock can get through breaks in fences, thereby defeating their purpose.

Although these mitigation strategies can help restore landscapes and thus positively impact the quantity and quality of water available, the strategies must overcome economic, social, and legal obstacles to be successful, including material resources and financing from the government or private enterprises, proof of owning a property to make changes to it, and a willingness to implement and maintain these strategies. For example, in Quingeo, there exist local water boards that are responsible for managing and protecting water sources and water recharge zones. Representatives of these boards, many of whom are also cattle ranchers, can petition the local and provincial governments to receive funding for mitigation strategies; however, each board has little legal power in practice because they only consist of a few representatives. ETAPA has proposed that the water boards unite across the communities to consolidate their power and make decisions that benefit the entire region.

Figure 2.6: A stream in Cochapamba Grande, Quingeo. The stream is protected on both sides by native grasses and vegetation.

Figure 2.7: Farmland in Cochapamba Grande. The trees are planted vertically to protect the pasture from the sun at its highest intensity.

Figure 2.8: A fence constructed to prevent cattle from accessing river water in Cochapamba Grande, Quingeo.

2.4 Influencing Behavioral Change with an Awareness Campaign

An important initial requirement to creating mitigation strategies is to ensure that people understand the problems they face and are motivated to change their behaviors. Technical solutions are valuable, but they often fail when not fully incorporated into a society which prevents their benefits from being fully reaped (Byrns, 2013). Awareness campaigns aim to solve this issue by analyzing public knowledge and perceptions of these problems and developing strategies to correct misunderstandings and change harmful behaviors (Bouder, 2013). Various models have been proposed to describe and guide successful awareness campaigns, such as the Theory of Planned Behavior and the Social Cognitive Theory (REACH, 2015). Also, the Transtheoretical Model of Change (TTM), a psychological model exemplifying the process in which individuals change their behaviors to address a problem, has been applied in a variety of contexts (Figure 2.9). For example, a group of WPI students applied the TTM to gauge consumer behaviors surrounding disposable plastics and provided a pathway to reduce disposable plastics in Hong Kong (McKay, McMahon & Bloniarz, 2018). With the help of the TTM, we outline the goals and steps of an awareness campaign.

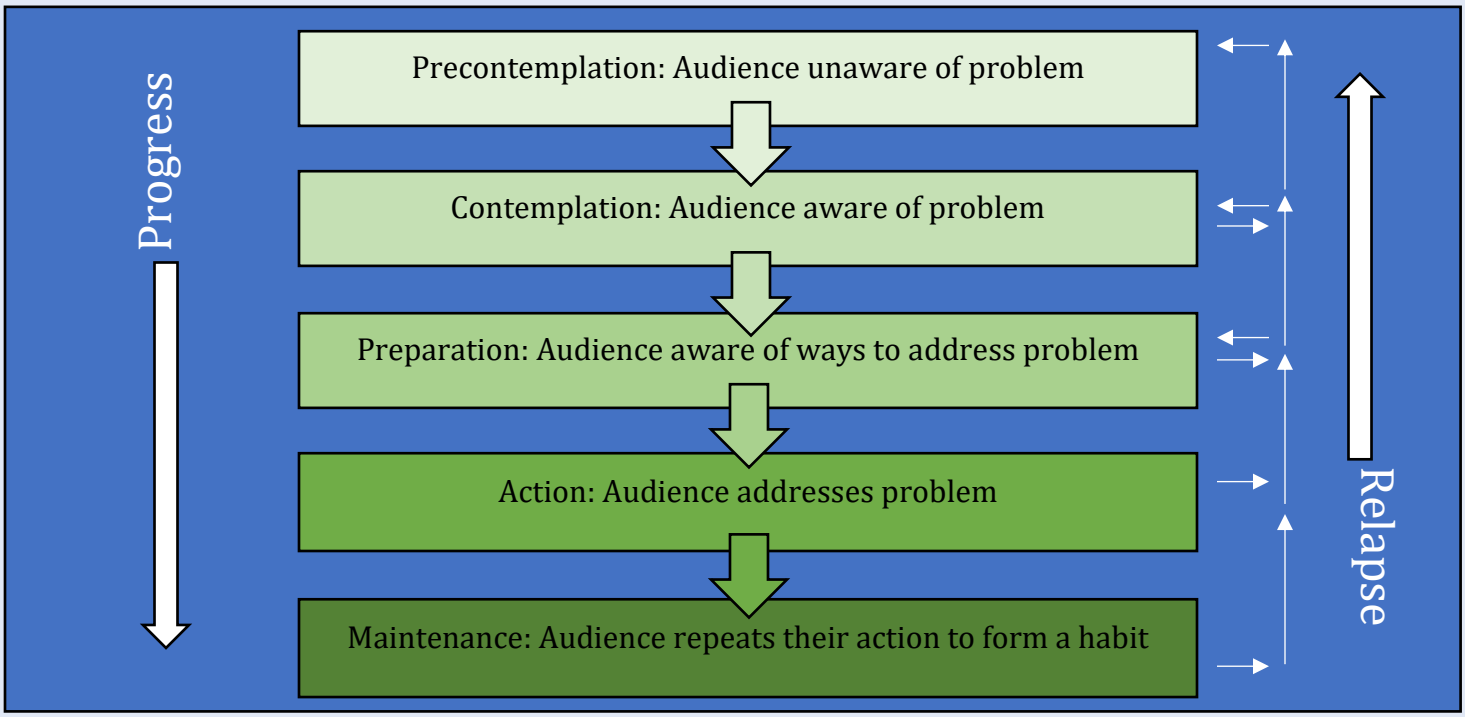

Figure 2.9: James Prochaska's Transtheoretical Model of Change demonstrates the steps an individual can take to initiate and maintain a behavior change (Prochaska, 1982).

The first step is to identify the audience. By recognizing key stakeholders, one can evaluate beliefs and behaviors specific to the observed demographics. For example, during the IQP based in Hong Kong, the students randomly surveyed 100 to 150 individuals above the age of 18 and "[used the] surveys to identify the thoughts, feelings and behaviors of Hong Kong residents regarding the utilization of disposable plastics in the food industry" (McKay et. al, 2018). They chose their target audience and evaluated their preconceptions. Additionally, the primary methods of receiving information help promote a desired message by offering knowledge in an acceptable manner (Morgan, Fischoff, Bostrom & Atman, 2001). An initial assessment can be used to characterize the target audiences' mental models, the thought processes about how something works in the real world (Morgan et al., 2001). In addition, mental models emulate precontemplation, the first stage of the TTM. This phase recognizes initial beliefs and behaviors of people that permitted the problem to exist (Prochaska, 1982). Like the transition in the TTM from precontemplation to the next step, contemplation, campaigns seek to reframe mental models from ones that incorrectly or incompletely understand a problem to ones that are aware of the problem.

The second step of the TTM in developing an awareness campaign is to utilize the mental models formulated in the first step to educate target audiences about the problem. Students conducting another IQP, also based in Hong Kong, aimed to discover an informed method of discouraging Japanese tourists from consuming shark fin soup. They evaluated tourists' current knowledge through surveys and promoted information through an app to "reinforce the user's positive association between sharks and the environment" (Mullen, Sun, MacGregor & Whittaker, 2018). The team, hypothesizing that the information would appeal to the collectivistic nature of the users, developed a "community frame" where individuals could view or create activist events. This customized education about problems troubling the region reflects the transition to contemplation, the second stage of the TTM. In this phase, individuals are aware of the need to make a change and look for ways to improve their situation (Prochaska, 1982). During the contemplation phase, economic, legal and social obstacles can deter individuals from knowing how to better their situation which prevents them from advancing through the TTM or even causes a relapse to an earlier stage (REACH, 2015). Although these obstacles can be difficult to overcome, campaigns are useful because they promote awareness about these obstacles and provide information about how to address them.

The third step of the TTM in developing an awareness campaign is to identify methods appropriate to each target audience to alleviate a problem with these obstacles in mind. When designing the app to dissuade tourists from shark fin soup consumption, the IQP team included a stage to provide "suggestions on what [tourists] can do to help" (Mullen et. al, 2018). The community frame and a news feed provided information and encouragement necessary for individuals to act against the problem within their abilities. This part of an awareness campaign mirrors the preparation phase of the TTM, where individuals know about a problem and possible methods to address it. Once individuals achieve this level, the individual can implement their knowledge and act (Prochaska 1982).

The TTM suggests that once members of a target audience have acquired appropriate information for understanding and mitigating a problem, the responsibility to enact change shifts to individuals. In both projects, the teams designed strategies to inform and motivate their audiences with the intent to motivate a desire to change behaviors. With the conclusion of a campaign comes action and maintenance, the final two stages of the TTM. In the action stage, individuals can act on their knowledge by implementing methods they learned in the preparation phase. As they repeat this change, they eventually transition to the maintenance phase, where they form habits that instantiate long-standing behaviors meant to fix a problem and prevent it from recurring (McKay et. al, 2018).

2.5 A Brief Summary

Our review of the literature revealed that economic, environmental, and social pressures influence poor ranching practices in Quingeo and more generally in Ecuador. These poor ranching practices pose threats to the quantity and quality of water available in Quingeo. Although mitigation strategies exist to address these threats, many economic and legal obstacles must be overcome to implement them. An awareness campaign can help by promoting awareness of these obstacles and suggesting ways to address them.

3 Methods

A ranching property in Cochapamba Grande, Ecuador.

Photo by Timothy McQuade

3.0 Research Methods

Our project goal was to design a set of strategies to raise awareness among relevant audiences about the impacts of cattle ranching practices on the water supply in the Quingeo Parish. To accomplish this goal, our project objectives addressed components of an awareness campaign, which are synonymous with the precontemplation and contemplation phases of the TTM:

1. identify all stakeholders related to the topic the campaign is about, as well as choose target audiences to appeal to,
2. characterize the audiences' attitudes and beliefs in order to understand how they feel about the campaign topic,
3. identify how the audiences receive information,
4. develop a strategy to promote awareness among the target audiences regarding threats to the water supply in Quingeo.

We worked with two communities in the Guaranjo watershed of Quingeo to gather this information: Punta Hacienda and Cochapamba Grande (Figure 3.1). These communities are important to study for three reasons. First, they are two of the only communities left in Quingeo that still contain native forests. Second, the native forests in these communities are declining which poses a threat to their water supplies. Third, they have two of the highest populations of water users in Quingeo which implies that these communities have a higher demand for water and thus have the most to gain from modifying their practices.

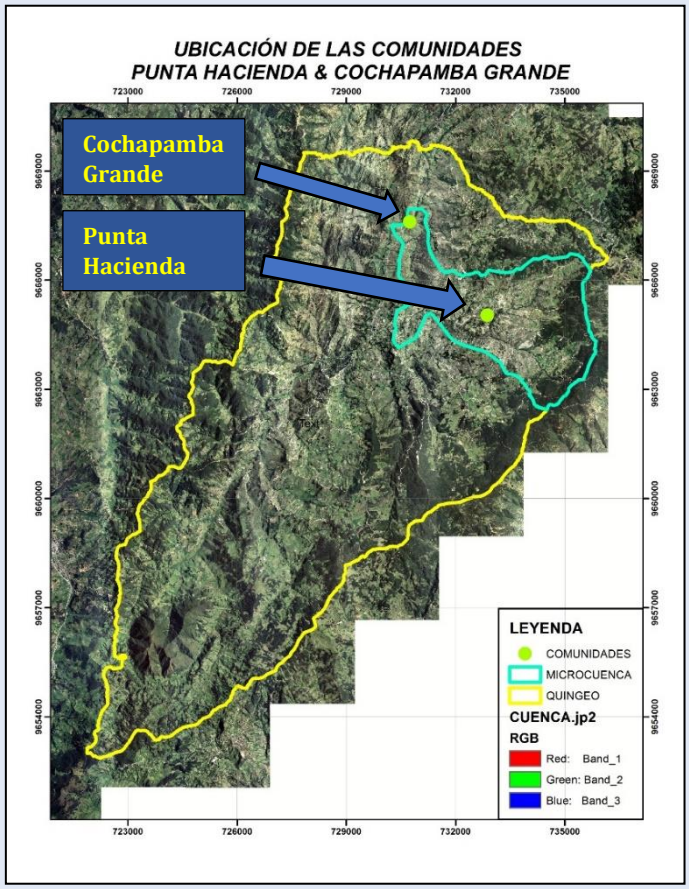

Figure 3.1: We worked with Punta Hacienda and Cochapamba Grande in the Guaranjo watershed of Quingeo (ETAPA, 2018).

3.1 Identify Stakeholders and Target Audiences

Our first objective was to identify the stakeholders using and impacting water sources in Cochapamba Grande and Punta Hacienda. We first consulted with ETAPA to develop a list of stakeholders. To determine target audiences, we divided the set of stakeholders into three groups based on their influence on effecting change and their initial awareness of threats to the water supply:

- community leaders, such as the president and water board representatives; they have influence oversee management of water systems and are respected in the community.
- cattle ranchers; they have some influence through changing their practices.
- teachers and students; teachers have influence through providing new information to their students, who are willing to learn.

With ETAPA, we constructed a table that provides the number of each of our target audiences in Punta Hacienda and Cochapamba Grande (Table 3.2, next page).

Group	Water Board Reps. (Leaders)	Cattle Ranchers	Teachers	Students
Group Characteristic	Work directly with governing water systems in Quingeo.	Rely directly on the water system for business and household needs.	Responsible for communicating new information to students.	Are more willing to learn and accept new information.
# Members in Punta Hacienda	5	100	5-8	100
# Members in Cochapamba G.	5	250	5-10	300

Table 3.1: A table describing the key characteristics of our target audiences, as well as the number of each type of audience in Punta Hacienda and Cochapamba Grande.

3.2 Characterize Attitudes and Beliefs of Target Audiences

First, to gather information from community leaders, we created and distributed surveys among 14 water board representatives that asked questions about their beliefs and concerns surrounding threats to the water supply, as well as their level of agreement with various messages we developed about the importance of protecting water sources (see Appendix A.1). We also conducted a formal interview with Rodrigo Rosendo Morales Gomez, the president of Quingeo. We inquired about Quingeo's history of land division, and how the divisions influenced poor ranching practices evident in Quingeo (see Appendix A.4).

Second, to gather information from ranchers, we conducted semi-structured interviews during field visits in Cochapamba Grande and Punta Hacienda. We asked ranchers questions about their practices to identify if they had implemented the mitigation strategies from our literature review, and if not, what prevented them from doing so (see Appendix A.3). We also aimed to better understand their daily routines working in pastures to gauge what kinds of threats the ranchers faced.

Third, to gather information from teachers, we held informal conversations with schoolteachers in both communities. We spoke to Carmita, a schoolteacher in Punta Hacienda, about job opportunities in rural settlements compared to the city. We also spoke to Diva, a schoolteacher at the school in Cochapamba Grande and an ETAPA employee, to understand differences between the modern "millennium" schools and the traditional rural schools.

3.3 Identify How Target Audiences Receive Information

To identify how target audiences received information, we created another survey and distributed it to the same 14 community leaders from the workshop discussed in the previous section (see Appendix A.2). Based on the literature review, we identified possible ways for an audience to receive new information to effectively promote awareness. The community leaders responded to questions about which mediums of communication, such as radio, television, or social media, they used most often. They provided their radio station preference, as well as common times they listened to the radio. They also responded to questions about Internet accessibility and whether they had cellphones. The survey also asked with whom they share information to gauge how information is transmitted among community members. We did not have time to distribute this survey to other audiences. We used parts of our literature review to understand how we could reach the other audiences.

3.4 Design a Set of Strategies to Promote Awareness

Our first three project objectives, together with the literature review, helped us design a set of strategies to promote awareness of threats to the water supply in Quingeo for each target audience. This included identifying information to present, developing materials for presenting this information, and identifying opportunities to utilize these materials for each audience. To evaluate the effectiveness of our awareness strategies, we asked for feedback from each audience to see what they learned. Based on this feedback, we adjusted our materials as final deliverables for our sponsor.

4 Findings

A tree that students planted at the millennium school in Cochapamba Grande.

Photo by Timothy McQuade

4.0 Findings

In this chapter, we present what we have learned that is relevant to an awareness campaign, including community dynamics, cattle ranching practices, and perceptions of the environmental impacts of these practices in Quingeo. We then present how we synthesized this information to design awareness strategies for each target audience. Finally, we discuss our engagement activities with school children and our participation with ranchers in mingas as mechanisms for promoting awareness of the impacts of cattle ranching practices on water sources in Quingeo.

4.1 Information Related to Developing an Awareness Campaign

4.1.1 Water board representatives want to protect water sources, but don't know what to do

Our first survey aimed to gather information surrounding the water board representatives' perceptions of messages related to protecting water sources. The first part of the survey listed five messages where the representatives identified on a scale from "Extremely Pertinent" to "Not Pertinent" how relevant each message was to the importance of protecting water sources (Table 4.1). Some participants would feel more strongly about one declaration over another; but regardless of the primary choice, every participant but one had a statement they valued as at least "Pertinent". This indicates that community leaders are aware of and want to address the problems they see, which is synonymous with the contemplation phase of the TTM.

Idea about Protecting Water Sources	% of Responses at or above "Pertinent"
Protecting water sources protects the land.	64%
Protecting water sources makes the land more profitable.	83%
Protecting water sources improves our health and safety.	82%
Protecting water sources is essential to ensure a stable water supply in the future.	90%
Protecting water sources is our moral obligation.	82%

Table 4.1: An excerpt from our survey data asking community leaders to rate how relevant the messages we developed were to protecting water sources.

The second part of the survey included questions about personal satisfaction with current ranching conditions and willingness to change ranching practices (Table 4.2). The water board representatives, who are also cattle ranchers, do not all agree about the quality of soil within their land nor the quantity of water that is available for human consumption; however, almost all agree that the quantity of water for agricultural use is unsatisfactory. More importantly, all the respondents stated they would like to change their methods but do not know how. This indicates gaps in information that prevent the representatives' transition from contemplation to preparation. Thus, the awareness strategy for water board representatives must introduce ways to address the problems they identified, such as promoting awareness of legal obstacles that inhibit change and introducing mitigation methods.

Satisfaction and Willingness to Change		
Declaration	# Agree	# Disagree
I am satisfied with the quality of soil on my land.	6	5
I am satisfied with the amount of water for agricultural use.	1	10
I am satisfied with the amount of water for human consumption.	6	6
The Parish government could do more to help me protect the water sources on my land.	7	3
I want to change my ranching practices, but I don't know how.	12	0
I want to change my ranching practices, but I am afraid of facing legal problems.	8	4

Table 4.2: An excerpt of our survey data asking community leaders how they feel about their land and water, and what prevents them from changing.

4.1.2 Parlantes and morning radio stations are popular ways of receiving information

Our second survey distributed to water board representatives asked how information is received and shared; the two most popular forms of news distribution were *Parlantes* and the radio (Figure 4.3). *Parlantes*, or "town criers," are announcements made by people or radio hosts in the center of town to broadcast news and information to community members. Additionally, listening to Sonada between 8:00 am and noon is the most popular choice (Figure 4.11). However, it is important to recognize the intersectionality of these choices. While Sonada is the most popular station and the morning is the most popular time, that does not prevent Sonada listeners from listening at any time besides the morning. This helped inform our awareness strategy for water board representatives by identifying how and when we can reach them.

Methods of Hearing News in the Parish	
Method	# Responses (out of 14)
Parlantes	9
Radio	5
Facebook	2
WhatsApp	2
Telephone	1
Social Media	1

Popular Radio Times/Stations			
Times		Stations	
Early Morning (4 AM – 8 AM)	3	Sonada	7
Morning (8 AM – 12 PM)	12	Tomebamba	6
Midday (12 PM – 4 PM)	6	Radio Maria	4
Afternoon (4 PM – 8 PM)	5	La Mega	3
Night (8 PM – 12 AM)	4	Super Ese	2
Late Night (12 AM – 4 AM)	0	Cauela	2

Tables 4.3 and 4.4: Excerpts from our survey data that asked community leaders to indicate how they received information, as well as the radio stations they listened to and when they listened.

4.1.3 Legal complications in Quingeo hinder water protection efforts

Rodrigo Rosendo Morales Gomez (Rosendo), the president of the Quingeo parish, explained how 70-80 percent of the property owners don't have legal deeds for their properties for two reasons:

1. many titles were lost during the agrarian reforms in the 1960s and 70s, and
2. there is no formal legal process to buying land; ranchers ask for the price of the land, and the deal is done.

The inability to prove rights to a property creates problems when another institution, such as ETAPA, wants to help repair or construct components of water systems that will benefit groups of property owners; they cannot do so if the property owner does not have the title to the land. For example, we visited El Verde, a community where ETAPA could not build a water storage tank because it was unclear who and how many people owned the land ETAPA wanted to use, and they could not secure permission to use the land. As discussed in the literature review, legal obstacles like these can prevent the representatives' transition from the preparation to the action phase. This interview indicated that our strategy for water board representatives needed to promote awareness of legal obstacles that inhibit change, as well as actions representatives can take to overcome these obstacles.

Figure 4.1: A view of the land in El Verde that would have held a water storage tank to serve the properties at the bottom of the hill with water for agricultural use.

"The first requirement is the deed, the *escritura*…but they [the landowners] don't have it. They don't have the legal power."

(Rodrigo Rosendo Morales Gomez, president of Quingeo)

4.1.4 Time limitations pose obstacles to implementing better practices

We also had informal conversations with ranchers from various communities. Most ranchers we talked to had fewer than 10 cows because they grew and took care of other things on their properties, such as herbs, fruits, horses, and guinea pigs. Many ranchers identified convenience as a major factor in many of their farming practices; one mentioned that she brought her five cows to a stream unless it rained, in which she would let them suck up the moisture from the grass and soil. Another explained that it was not worth the time to distribute or pick up cow feces, because they dried out quickly and did not offer much value. We observed that most ranchers in Quingeo tie their cattle to posts with short ropes to prevent them from grazing freely on other properties. However, they also mentioned that they often crossed over other landowners' properties with their cattle to get to water sources. These conversations helped inform our awareness strategy for ranchers by revealing time limitations as potential obstacles to implementing better practices. Thus, our awareness strategy for ranchers must propose ways to address these limitations to transition ranchers from the contemplation to preparation phase.

Figure 4.2: A guinea pig farm we visited in Cochapamba Grande. For many ranchers, tending to cattle was only one of many duties on their properties.

"Of course I bring my cows to a stream near me. I don't have troughs; it's the best I can do."

(Rancher in El Verde, Quingeo)

4.1.5 Classroom styles and resources differ across traditional and millennium schools

Finally, we had informal conversations with school teachers to learn more about the educational system in Quingeo. Carmita, a teacher in Punta Hacienda, explained how many kids begin their education in traditional schools and then attend the millennium school in Cochapamba Grande. Diva, a teacher in Cochapamba, explained how the millennium school provides better education and opportunities for students than they would receive in the traditional schools and is subsidized by the government. We observed many differences between the two schools, including the availability of a computer lab in the millennium school. These differences indicated that we needed to modify the materials that we developed for the two schools to appeal to the different ways in which the students receive information.

The teachers also discussed how some students who attend the millennium schools leave their original communities to work in the larger cities or move to Europe and the United States to support their families. They emphasized how the migration of these students, who they believe to be future leaders, leave rural communities without people to solve the problems that threaten rural livelihoods. Thus, our awareness strategy for students must emphasize information that will inspire them to work in their communities, thereby transitioning them from precontemplation to contemplation.

Figure 4.3: A view of the millennium school's computer lab in Cochapamba Grande. Facilities like these distinguish it from traditional, rural schools.

"The students go to the millennium school for better opportunities."

(Diva, a schoolteacher from Cochapamba Grande)

4.2 Conceptualizing How Problems in Quingeo are Connected

The information we gathered from surveys and conversations with community members not only gave us a better understanding of the ranching practices that currently exist in Quingeo, but also of the factors that influence these practices and the threats that arise from them. We conceptualized this information into a diagram that relates external factors, such as the division of land and seasonal waterfall, to cattle ranching practices and their effects. The complete diagram can be found in Appendix B. Here we present some of the causal pathways that we discovered through surveys and interviews. These pathways help inform our awareness strategy by identifying which parts of the pathways our project can address.

4.2.1 Land divisions lead to overgrazing which leads to agricultural runoff and contamination of water sources

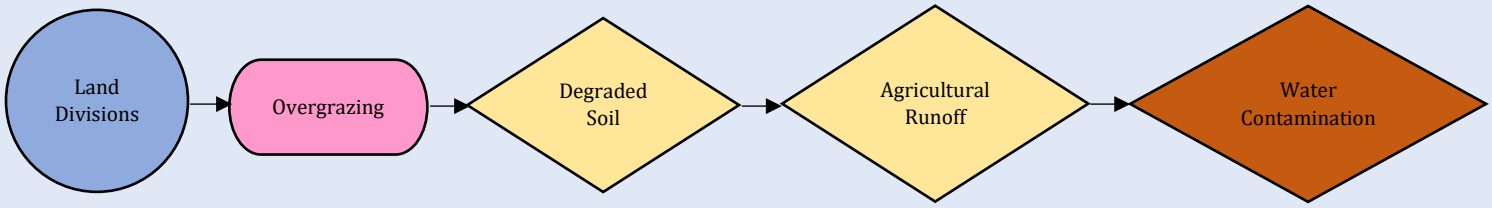

Figure 4.4: A pathway that illustrates how land divisions influence overgrazing which lead to agricultural runoff and contamination of water sources in Quingeo.

As described in Chapter 2, agrarian reforms in the 1960s and 70s divided the land between working class families, thereby shrinking the available grazing land on each property. To accommodate raising cattle on these small areas, ranchers tie cattle to posts and restrict them to small spaces. The result is that cows trample and eat grass around them before it can regrow which leads to degraded soil quality; thus, the soil's ability to hold water and slow contaminants is impaired. Phosphorous from cow patties and iron from dissolved pasture sediment flow into streams, thereby decreasing the quality of the water and making it unhealthy to drink without being filtered. Furthermore, pasture management is difficult in Quingeo because of factors such as low rainfall. These obstacles make it imperative that our awareness strategy for ranchers promotes better pasture management practices to address this pathway.

4.2.2 Resource limitations complicate riparian zone management practices that could help protect water sources

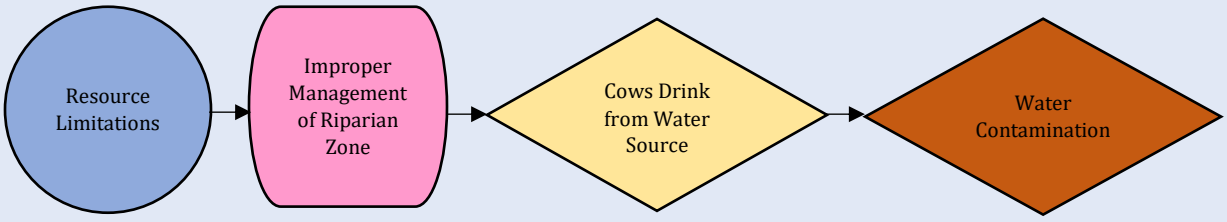

Figure 4.5: A pathway that illustrates how resource limitations hinder development of the riparian zone and allow cattle to drink from water sources and contaminate them.

The lack of materials and manpower to build a fence around a water source allows other ranchers to bring their cows to streams and let them drink from it. The cattle can spread disease through bacteria in its mouth, and their byproducts can directly enter the stream. This leads to water contamination and consequently a decrease in the quality of local water sources. This helps inform our awareness strategy for ranchers by indicating that we must introduce methods to overcome these resource limitations. Furthermore, the literature review and our survey data indicates that a lack of agricultural water poses obstacles to improving the riparian zone. For example, it does not make sense for ranchers to build a fence to protect water sources if it cuts off their only means of giving water to their cattle. Thus, our awareness strategy for ranchers should incorporate alternatives to letting cows drink from streams. As one example, watering troughs curb the need to use water sources directly. It is essential to promote awareness of the reasons to use watering troughs and present implementation methods, such as rain collecting devices.

4.2.3 Lack of information, time, and resources prevent cow manure from being spread

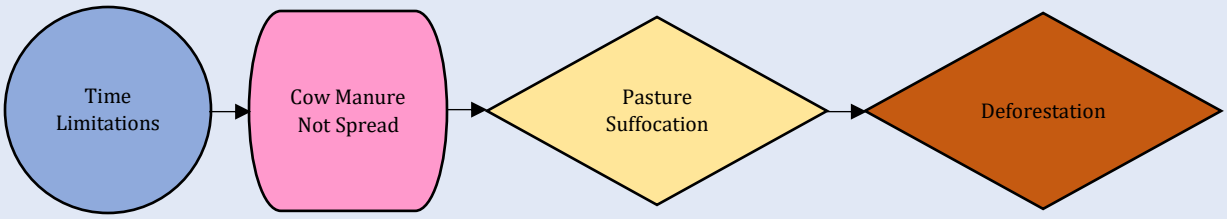

Figure 4.6: A pathway that illustrates how time limitations contribute to cow manure not being spread.

As we described in Chapter 2, cow manure can be used as a resource to fertilize pastures; however, when cow patties are left unmanaged, they create dead spots in the pasture that are unusable for grazing or growing crops and facilitate a source of agricultural runoff contaminating water sources. Our interviews revealed that ranchers face time and resource limitations that prevent them from spreading cow patties. Furthermore, there are misunderstandings about the benefits of spreading cow patties, as the ranchers we spoke with said they didn't feel it was worth their time. Thus, our awareness strategy for ranchers must not only identify opportunities that can help them overcome these limitations, but also promote information that encourages them to adopt this practice.

4.3 Designing Awareness Strategies

The information we gathered in our initial findings and the information from our literature review helped us design awareness strategies for each of our target audiences. We followed three steps to design the strategies.

- First, we identified types of information to present to our target audiences. Our survey data revealed that there are gaps in information about the factors that influence poor ranching practices in Quingeo; these gaps make the transition from precontemplation to contemplation difficult. Thus, we focused on developing materials that promoted awareness of these factors and intervened in the pathways we described in Section 4.2. Additionally, our interview data with ranchers revealed that time and resource limitations present obstacles that prevent them from implementing better ranching practices. Thus, we also focused on promoting awareness among cattle ranchers and students of opportunities that can help address these obstacles.

- Second, we identified types of materials to develop for our awareness strategies. We developed a presentation about deforestation for students; however, we used a PowerPoint presentation for the students in Cochapamba Grande and a poster presentation for the students in Punta Hacienda due to the differences in technology access. For the ranchers, we identified mingas, or community work efforts to improve aspects of a property, as an opportunity to strengthen community values and to introduce better cattle ranching practices.
- Third, we identified opportunities to utilize the materials as a way of testing our awareness strategies. We coordinated times during the school week to present to the students and days to work in mingas with ETAPA and the ranchers. We did not have time to test our materials on water board representatives. However, the materials we developed, such as the deforestation presentation, could be used in workshops that ETAPA already runs for the representatives.

4.4 Analysis of Community Engagement Activities

4.4.1 Mingas are opportunities for information and resource sharing

During the mingas, we helped construct fences to protect local water sources from cattle, which the property owners agreed to. During these events we established rapport with the community, and later asked about the importance of the minga. We observed that mingas help provide a sense of unity within the community. We saw many familiar faces at the mingas we attended, not to mention that many participants shared their tools, drinks and food. After we finished the minga, all the volunteers sat and ate together. Participants looked forward to catching up with neighbors and having laughs with friends.

The mingas were effective strategies to promote awareness because they provided opportunities for information exchanges between ETAPA, the ranchers, and us. Mingas can be used as opportunities to correct misunderstandings about the benefits of certain ranching practices, like the benefits using hay and cow patties to create fertilizer; information like this helps ranchers' transition to the action phase of the TTM. Furthermore, mingas provide opportunities for resource sharing, such as gathering wood and barbed wire for fences, that help address resource limitations. Hands on work paired with explanations of how these projects can affect the environment in the long term make mingas powerful tools for change in Quingeo.

"We can get a lot of work done in just a little time, and everyone helps out."

(A rancher from one of the mingas)

4.4.2 Educational activities encourage critical thinking about problems in Quingeo and their causes

We gave a presentation to students in Punta Hacienda and Cochapamba Grande about deforestation. As discussed in Section 3.4, we gave a PowerPoint presentation to the students in Cochapamba and a paper presentation to the students in Punta Hacienda. The presentation was split into three parts:

1. The importance of trees and forests and a definition of deforestation,
2. The deforestation problem in Quingeo and why deforestation occurs, and
3. Reforestation as a strategy to fix the problems deforestation causes.

After the presentation about deforestation and the tree-planting activity in Punta Hacienda, we asked the students "What functions do trees serve?" Sample responses included "They give us fruits and clean air" and "They protect the water." A profile of additional student responses from Punta Hacienda can be found in Appendix E.2. We decided to reframe the question for the next group of students to encourage critical thinking beyond the information we offered, as a way of getting students to think more about the causes of the problems, in addition to the problems themselves. As a result, we asked the Cochapamba Grande students "Why do people cut down trees, and what problems result?" Sample responses included "To build furniture and houses" and "To make a living and put their cows [where the trees were]." A profile of additional student responses from Cochapamba Grande can be found in Appendix E.1.

Between the presentations in both communities, we had positive interactions with the students, and they seemed willing to learn and play. The presentations in both communities intended to encourage the students' transition from precontemplation to contemplation by making them aware of the deforestation problem. The students readily accepted the information, thereby overcoming a potential obstacle of not wanting to learn. Furthermore, the students related this information to their own lives and experiences and learned about ways to solve the problem at school and at home which helps them make the transition from contemplation to preparation. These activities certified educational activities as an acceptable strategy to promote awareness among students.

"The kids here love to learn and play when they meet students like you."

(Carmita, a teacher in Punta Hacienda)

4.5 Limitations of Findings

4.5.1 Number of community members reached

During our field work, we experienced some problems with access that prevented us from going to the two communities as often as we would have liked. The erratic schedules of ranchers, combined with school vacation during the second to last week of February, made it difficult to reach these audiences. Thus, what we learned was limited because we spoke with fewer community members than we hoped.

Additionally, some of our survey and interview data may be skewed based on the populations we sampled. For example, when inquiring about cattle ranching beliefs and methods of communication, we focused on the water board representatives because of challenges meeting with ranchers and students for this information. Furthermore, responses from only 14 of the 40 water board representatives in Quingeo may have left out important perspectives from other representatives. With these gaps in data from all three target audiences, our results do not necessarily display the span of the communities' ideas and perceptions.

4.5.2 Perceptions of ETAPA

The division of ETAPA that sponsored our project is responsible for the management and protection of watersheds in the Cuenca canton. Residents' perceptions of ETAPA and its motives for working in Quingeo may have influenced what they were willing to share with us about their practices and attitudes. Ranchers and community leaders may have felt that they could face repercussions for what they told us, and thus avoided talking about sensitive topics, such as the political and legal atmosphere in Quingeo.

4.5.3 Timing of research

We conducted our research during Ecuador's rainy season. In our field visits, ranchers mentioned that the dry season is very tough for them because they receive very little water and do not have means to store water during the rainy season. Thus, the practices we observed may differ depending on the time of year, and we didn't have the opportunity to observe first-hand the land conditions during the dry season.

4.6 A Quick Summary

In summary, our findings helped us create a context for the problems in Quingeo and develop awareness strategies for each of our target audiences. Furthermore, we found that our target audiences were receptive to the community engagement activities we created and learned more about factors that lead to poor farming practices in Quingeo and ways to address these factors. The next chapter discusses recommendations we have for ETAPA with respect to the awareness strategies we developed.

5 Recommendations

A view of a crop field near Quingeo's central plaza.

Photo by Timothy McQuade

5.0 Recommendations

This chapter presents our recommendations to our sponsor ETAPA about how they can extend the awareness strategies we developed to address obstacles that prevent people from acting on their new knowledge. These recommendations are based on our analysis of the community engagement activities, as well as the information we gathered from surveys and informal conversations.

5.1 Address Obstacles to Change in Workshops with Water Board Representatives

Based on our survey data and conversations, many of the Quingeo water board representatives want to change their farming practices, but they don't know what to do. One insight that can be drawn from these opinions is that representatives are unsure of how to overcome economic and legal obstacles that inhibit changing ranching practices. We recommend that ETAPA incorporate themes related to upstream factors in the causal pathways we developed, such as the motivations for clearing land and the benefits of spreading cow patties, in workshops with community leaders. These themes would encourage discussions on how to address these factors, which in turn would help address the harmful causal pathways and protect water sources in the long term. ETAPA can also facilitate conversations related to uniting the water boards to provide more legal power to representatives and overcome legal limitations.

5.2 Incorporate Messages and Better Practices into Ranching Workshops

ETAPA should integrate the messages and practices we developed that promote protection of water sources into workshops for ranchers (see Sections 4.1.1 and 4.2). From our research, we found that messages related to moral obligations and land profitability were two topics that community members identified with. These messages could serve to inform community members of the workshops' goals. Furthermore, these messages could serve as the launchpad from which better farming practices can be introduced.

As one example, the concept of rotational grazing could be integrated into workshops. Rotational grazing is a method of ranching using smaller pastures and moving the cattle more often. This is ideal for the communities we worked in, as they have smaller parcels of land caused by land divisions and inheritance patterns. It is essential that pastures are given more time to regenerate, since we found in our literature review that pastures are often overgrazed. Rotational grazing also ensures that all available grass gets grazed in each pasture, which is essential for proper regeneration. When pastures are given the time needed to regenerate, they develop deeper root systems which makes them hardier in the long run. The grass is then able to absorb more water and filter more runoff. Furthermore, if done properly, more cows can be managed in less space, which would mitigate herd overpopulation. Rotational grazing is a technique that fits Quingeo because it yields better pasture quality and decreases the pressure to clear land for more pasture.

Another example of a beneficial ranching practice is rainwater collection. In one survey of community leaders, many reported that they didn't use watering troughs because they didn't have water for them. Watering troughs can be placed at the top of the hill to collect rainwater for agricultural use. To see a model of a simple rain collection device we constructed using SolidWorks, refer to Appendix C.

5.3 Introduce New Strategies to Protect Water Systems through Mingas

Mingas are historic and powerful community building events and many of them focus on improving aspects of the land. From our findings, mingas are effective platforms to spread awareness and introduce new information, and we recommend that ETAPA can further utilize this opportunity to increase information sharing between community members. One idea is to incorporate a workshop-based minga that educates ranchers on methods to compost cattle manure. In the background section, we discussed how manure can be used to create fertilizer, but it can be harmful to the pastures and water systems if not managed properly. However, in the findings section, we learned that some ranchers didn't feel it was worth their time to manage the cow manure. In a workshop-based minga, ETAPA can detail the benefits of composting cow manure, such as the ability of organic fertilizer to help pastures regenerate faster. Additionally, by removing and using the cow manure there will be no burn spots within pastures caused by unmanaged cow patties which improves the quality of the pasture. Finally, it will help the water system because removing the patties decreases the risks from agricultural runoff. We believe these benefits will incentivize ranchers to manage cow patties. ETAPA would need to provide resources such as straw to help overcome resource limitations, as cow manure alone cannot effectively be composted into fertilizer.

5.4 Integrate New Educational Materials into Environmental Initiatives for Students

As described in Chapter 1, ETAPA already has environmental educational programs and materials that teach students about protecting water sources; however, our sponsor remarked that the materials do not explain why these problems occur and what students can do to address these problems. We recommend that ETAPA integrate educational materials and hands-on activities we developed, such as our deforestation presentation, into their programs to address the causes and impacts of cattle ranching practices on the water supply in Quingeo. As discussed in Chapter 4, our educational materials helped promote critical thinking about these problems and allow students to relate this information to their lives. Furthermore, these activities can serve as interventions in the causal pathways we highlighted by teaching students about actions they can take to address these pathways.

6 Conclusions

A house near Quingeo's central plaza.

Photo by Timothy McQuade

6.0 Conclusions

Access to clean water is critical to support growing populations; however, many obstacles still exist that pose complications to securing clean water. Our project work in Quingeo has touched the surface of the complex social, political, legal, and economic factors that shape the threats Quingeo faces to its water supply. The strategies and activities we developed for our target audiences have helped promote awareness of these factors and methods to address them. It is our hope that our sponsor ETAPA and future groups working in the region can look to and build on the strategies we've identified to continue promoting awareness of the threats and implementing mitigation methods to handle them.

During our visit to Punta Hacienda, we brought up in our presentation that trees represent the future – they provide homes for animals, oxygen for humans to breathe, and protection for the land from the sun. Perhaps the small trees we planted in Punta Hacienda and Cochapamba Grande represent planting the seeds of education and change in Quingeo.

Figure 6.1: Our project group eating chicken and cuy (guinea pig) after a minga. We hope that our project work in Quingeo has helped lay the foundation for the "campaign of tomorrow."

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Appendices

Students planting a tree in Punta Hacienda, Ecuador.

Photo by Timothy McQuade

A.1: La encuesta sobre los mensajes y estilo de vida

(A.1: Survey involving messages and lifestyle)

Parte 1: Señale con una X, lo que Usted considere con relación a "la idea de la protección de fuentes de agua"

	Idea Sobre la Protección de las Fuentes de Agua	Impertinente	No Muy Pertinente	Pertinente	Muy Pertinente	Extremadamente Pertinente
1	La protección de las fuentes de agua protege el terreno.					
2	La protección de las fuentes de agua hace más rentable el terreno.					
3	La protección de las fuentes de agua aumenta nuestro salud y seguridad.					
4	La protección de las fuentes de agua es imprescindible para asegurar un suministro de agua estable en el futuro.					
5	La protección de las fuentes de agua es nuestra obligación moral.					

Parte 2: Señale con una X, lo que Usted considere con relación a

Las Declaraciones	Sí	No Sabe No Opina	No
No vacuno a mis vacas para que ahorre dinero.			
La vacunación de las vacas no es útil contra las infecciones bacterianas.			
La dispersión de las heces toma demasiado tiempo.			
Prefiero que mis vacas beban del río, a diferencia de instalar los abrevaderos.			
La deforestación no es un problema tanto grande como las otras personas dicen.			
Me preocupa que haya parásitos en el agua que bebo.			
Me preocupa que haya parásitos en el agua que beben mis vacas.			
A menudo tengo problemas con obtener el agua limpia.			
A menudo discutir la división de los terrenos con mis vecinos.			
Estoy satisfecho con la calidad del suelo en mi terreno.			
Estoy satisfecho con la cantidad del agua disponible para el uso agrícola.			
Estoy satisfecho con la cantidad del agua disponible para el consumo humano.			
El gobierno parroquial podría hacer más para ayudarme proteger las fuentes de agua en mi terreno.			
Más vacas en el terreno serían útiles para producir más.			
Mi propiedad es más productiva durante la estación lluviosa.			
A menudo encuentro que necesito más terreno para los animales.			
Aprendí mucho de las prácticas ganaderas de mis padres o de mis familiares.			
Quiero cambiar las prácticas ganaderas que utilizo, pero no sé cómo hacer.			
Quiero cambiar las prácticas ganaderas que utilizo, pero tengo miedo de enredarme en los problemas legales.			
Me gustaría ganar más dinero para que pueda ahorrar en el banco para mi familia.			
Creo que la calidad del terreno y la calidad del agua son vinculadas.			

A.2: La encuesta sobre los medios de comunicación

(A.2: Survey involving means of communication)

Encuesta sobre los medios de comunicación

Esta encuesta contiene preguntas sobre los medios que se usan para recibir la información. Por favor indique con una X en las Casillas de verificación aplica a usted. Si selecciona "Otra repuesta' para una pregunta, por favor escribe su repuesta brevemente.

1. ***En promedio, ¿cuántas veces por semana lee el periódico?***

□ Nunca

□ 1-2 veces

□ 3-5 veces

□ 6-7 veces

---

2. ***En promedio, ¿cuántas veces por semana escucha al radio?***

□ Nunca

□ 1-2 veces

□ 3-5 veces

□ 6-7 veces

---

3. ***¿Qué radio escucha con frecuencia …?***

□ SONONDA

□ RADIO MARIA

□ TOMEBAMBA

□ _____

□ _____

□ _____

□ _____

□ _____

4. ***¿A qué hora escucha la radio? Selecciona todo lo que corresponda.***

□ Madrugada (04H00-08H00)

□ Mañana (08H00-12H00)

□ Mediodía (12H00-16H00)

□ Tarde (16H00-20H00)

□ Noche (20H00-24H00)

□ Medianoche (24H00-04H00)

---

5. ***¿Cuáles tipos de programas escucha al radio? Selecciona todo lo que corresponda.***

□ Programas de música

□ Programas de noticias

□ Programas de show

□ Programas de deportes

□ Otra respuesta (Explique): _____

A.2, continuado
(A.2, continued)

7. ¿Tiene acceso al internet en su casa?

□ Sí

□ No

---

8. ¿Tiene acceso al internet en su lugar de trabajo?

□ Sí

□ No

---

9. ¿Tiene un móvil celular?

□ Sí

□ No

---

10. Si tienes un móvil celular, ¿qué tipos de aplicaciones usa? Selecciona todo lo que corresponda.

□ WhatsApp

□ Facebook

□ Snapchat

□ Instagram

□ Nada / no tengo móvil

□ Otra repuesta (Explique) _____

---

11. Cuando escucha a las noticias, ¿con quién habla? Selecciona todo lo que corresponda.

□ Familiares

□ Amigos

□ Vecinos

□ Colegas

□ Nadie

□ Otra repuesta (Explique): _____

---

12. Indique cómo se entera de las noticias de la comunidad y de la Parroquia.

□ _____

□ _____

□ _____

□ _____

A.3: Una lista de preguntas para los ganaderos
(A.3: List of questions for cattle ranchers)

La siguiente lista describe los tipos de preguntas que hemos formado para tener una conversación con los ganaderos. No es una lista ordenada, sino que nos ayudará anticipar los temas que pueden surgir de la conversación. También no es una lista exhaustiva, sino se constituye el base de la información que queremos recabar.

(The following list describes the types of questions we have prepared for a conversation with ranchers. This is not an ordered list; rather, it will help us anticipate the themes that may arise from the conversation. It is also not an exhaustive list, but rather it constitutes the base of information that we want to gather.)

- Hola, soy un parte de un grupo de estudiantes que está trabajando en esta región. Nos gustaría que cuente Ud. unos detalles de su vida para darnos un mejor contexto de las vidas de los ganaderos aquí.
- (Hello, I am a part of a group of students that is working in this region. It would please us if you told us some details about your life to give us a better context of the lives of ranchers here.)

- ¿Cuánto tiempo ha vivido/trabajado aquí?
- (How long have you lived/worked here?)

- ¿Vive cerca/lejos del pasto? ¿Vive solo, o tiene una familia que vive con Ud.?
- (Do you live near or far from the pasture? Do you live alone, or with your family?)

- ¿Cuántos ganados tiene Ud.? ¿Tiene otros tipos de animales, o sólo ganado? ¿Tiene un jardín también?
- (How many cattle do you have? Do you have other kinds of animals, or just cattle? Do you have a garden as well?)

- ¿Cuántos ganados producen leche?
- (How many cattle produce milk?)

- ¿Cuántas veces por día ordeña y alimenta a sus ganados? ¿Requiere mucho tiempo? ¿Previene que haga otras cosas?
- (How many times a day do you milk and feed your cows? Does it take a lot of time? Does it prevent you from doing other things?)

- ¿Vacuna a sus ganados? ¿Con qué frecuencia?
- (Do you vaccinate your cattle? With what frequency?)

- ¿Si tuviera más tiempo en su día, qué haría Ud.?
- (If you had more time in your day, what would you do?)

- ¿Cómo es su horario durante la semana?
- What is your schedule like during the week?

A.3, continuado

(A.3, continued)

- ¿Tiene Ud. otros trabajadores, o trabaja solo/a? ¿Cuáles tipos de cosas hacen sus trabajadores? ¿Comunica con ellos a menudo?
- (Do you have other workers, or do you work alone? [If you have other workers] What types of things do your workers do? Do you communicate with them often?)

- ¿Cómo ha cambiado el terreno a través de los años? ¿Es mejor o peor?
- (How has the land changed over the years? Is it better or worse?)

- ¿De dónde recibe Ud. el agua para consumo?
- (Where do you receive water for consumption?)

- ¿Cuáles tipos de actividades son disponibles en la comunidad?
- (What types of activities are available in the community?)

- ¿Cuáles tipos de plantas existen en su terreno? ¿Qué función sirven?
- (What types of plants exist on your land? What function do they serve?)

- ¿Recibe mucha lluvia su terreno? ¿Recoge el agua cuando llueve?
- (Does your land receive a lot of land? Do you collect water when it rains?)

- ¿Cómo siente sobre la calidad del agua? ¿Cree Ud. que es limpio? ¿Tiene bastante agua para todas sus actividades?
- (How do you feel about the quality of water? Do you believe it is clean? Do you have enough water for all your activities?)

- ¿Hay algo que quiere cambiar sobre su estilo de vida?
- (Is there something you want to change about your lifestyle?)

A.4: Una lista de preguntas para el presidente Rosendo

(A.4: List of questions for the president Rosendo)

La siguiente lista describe los tipos de preguntas que hemos formado para tener una conversación con el presidente de Quingeo. No es una lista ordenada, sino que nos ayudará anticipar los temas que pueden surgir de la conversación. También no es una lista exhaustiva, sino se constituye el base de la información que queremos recabar.

(The following list describes the types of questions we have prepared for a conversation with the president of Quingeo. This is not an ordered list; rather, it will help us anticipate the themes that may arise from the conversation. It is also not an exhaustive list, but rather it constitutes the base of information that we want to gather.)

- ¿Cuáles son las responsabilidades de su trabajo? ¿Con cuáles tipos de personas trabaja Ud.?
- (What are the responsibilities of your job? What types of people do you work with?)

- ¿Qué es el proceso en que se hacen las decisiones en las comunidades? ¿Qué es el papel que tiene la comunidad en hacer las decisiones? ¿Y usted?
- (What is the process in which decisions are made in the communities? What role does the community have in making decisions? And you?)

- ¿Cómo se maneja el desacuerdo cuando se hace una decisión en las comunidades?
- (How is disagreement managed when a decision is made in the communities?)

- ¿Cuáles problemas cree Ud. que son los más difíciles de resolver? ¿Cuáles son algunos de los factores que contribuyen a la complejidad de estos problemas?
- (Which problems do you believe are the most difficult to resolve? What are some factors that contribute to the complexity of these problems?)

- ¿Cómo ha cambiado el terreno a través de los años? ¿Es mejor o peor? ¿De qué manera?
- (How has the land changed over the years? Is it better or worse? In what ways?)

- ¿Cuáles tipos de desafíos existen en el sistema de educación? ¿Qué es su opinión en las escuelas modernas, en contraste con las escuelas tradicionales?
- (What types of challenges exist in the education system? What is your opinion on modern schools, in contrast with traditional schools?)

- ¿Cómo se define el proceso de la herencia del terreno? ¿Hay una diferencia entre la herencia del ganado y el terreno?
- (How is the process of land inheritance defined? Is there a difference between the inheritance of cattle and land?)

- ¿Cómo se define el proceso del desmonte de tierras? ¿Quién pide el servicio, y cuánto cuesta? ¿Quién paga por el servicio?
- (How is the process of land clearing defined? Who asks for the service, and how much does it cost? Who pays for the service?)

A.4, continuado

(A.4, continued)

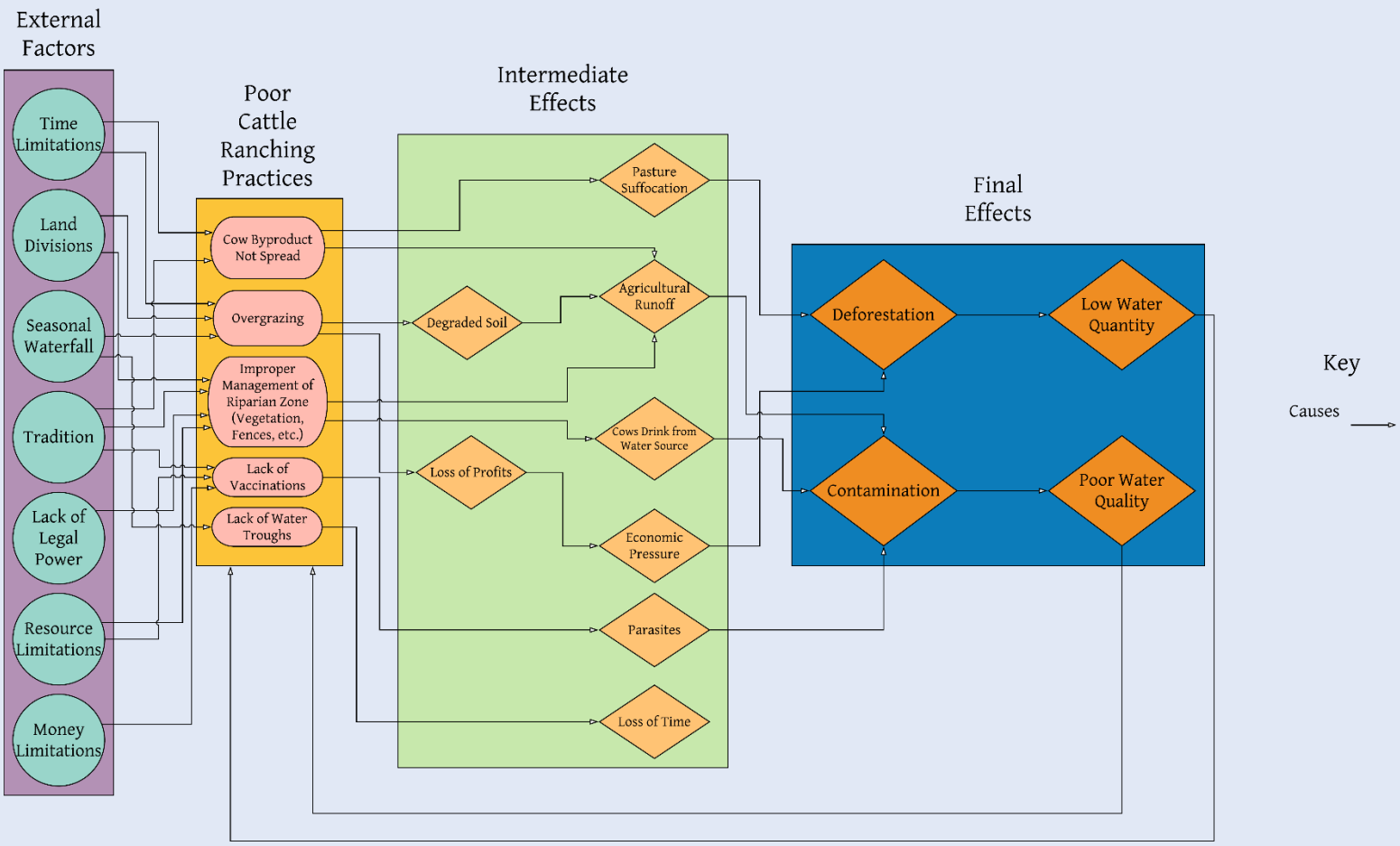
- ¿Cuáles tipos de poderes tienen las juntas de agua en la comunidad? ¿Cree Ud. que la unificación de las juntas sería mejor para dar más poder legal a las comunidades?
- (What types of powers do the water boards have in the community? Do you believe that the unification would be better to give more legal power to the communities?)

- ¿Qué es la relación entre las comunidades de Quingeo y ETAPA? ¿Hay algunas comunidades que están más abiertos a los cambios de las prácticas de ganadería que otras?
- (What is the relation between the communities of Quingeo and ETAPA? Are there some communities that are more open to changes to cattle ranching practices than others?)

- ¿En su opinión, cuáles son los problemas más grandes que enfrentan las comunidades de Quingeo? ¿Qué puede ser hecho para resolver estes problemas?
- (In your opinión, what are the biggest problems that the communities of Quingeo face? What can be done to solve these problems?)

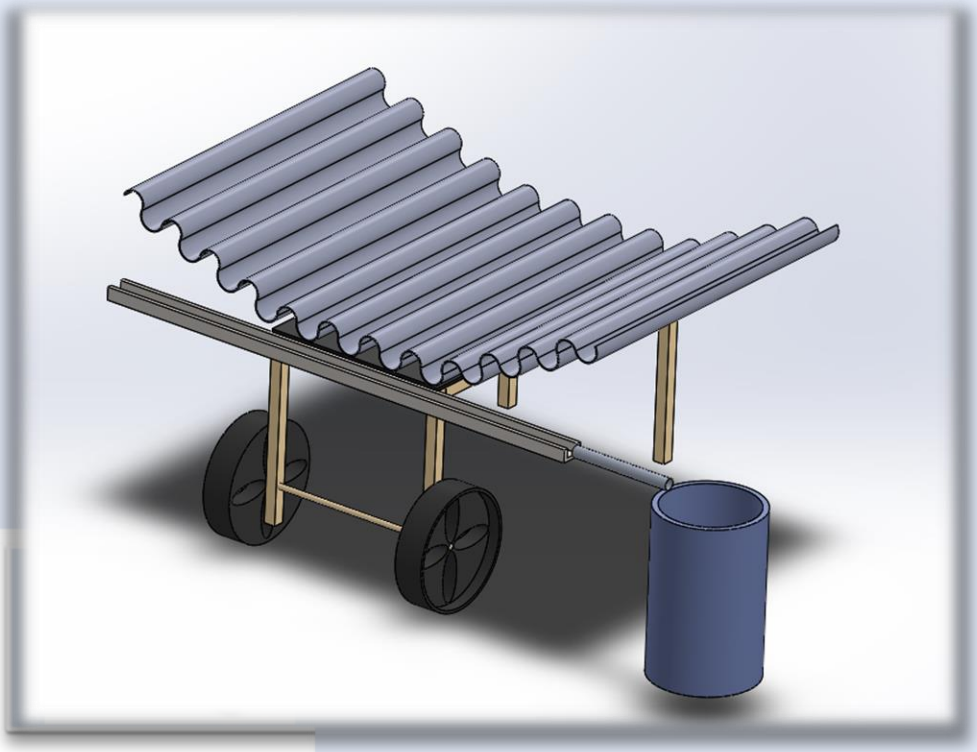
B: Un diagrama de las causes, las prácticas, y los efectos en Quingeo

(B: Diagram of causes, practices, and effects in Quingeo)



C: Un modelo para colectar lluvia, hecho en SolidWorks

(C: Model to collect rainwater, made in SolidWorks)



Portable Raincatcher

Assembly Name : Transportable rain catcher
Assembly Number : 1
Assembly Revision : 1
Creation Date : 19-Feb-19
Part Count : 41

Part #	Part Name	Description	Qty	Units	Picture
1	Tin Roofing	Metal, Corrigated	4		
2	Gutter	Metal	3		
3	Base support legs	Wooden	4		
5	Base legs support	Wooden	2		
6	upper support	Wooden	4		
7	Hinges	Metal	4		
8	Bolt	Metal	12		
9	55 gallon barrel	Metal	1		
10	Tubing	Rubber	2		
11	Valve	Metal	2		
12	Wheel	Rubber	2		
13	Axle	Wood	1		
	Total		**41**		

D: Los enlaces para los videos sobre nuestro trabajo

(D: Links to videos about our project work)

We created a video that summarizes our project work in Quingeo. We uploaded two versions, one with English subtitles and one with Spanish subtitles.

https://youtu.be/8BN9d4BbRSM (Spanish subtitles)

https://youtu.be/zmsnpTRwGog (English subtitles)

E.1: Los estudiantes de Cochapamba Grande

(E.1: Students from Cochapamba Grande)

"Las personas cortan árboles para hacer tablas y construir muebles. Cuando cortan árboles no producen oxígeno ni vida"

("People cut down trees to produce wooden boards and build furniture. When they cut trees, neither oxygen nor life is produced.")

"Las personas cortan los árboles para tener dinero y para hacer casas. El problema es que se mueren los animales y no habrá agua."

("People cut down trees to earn money and make houses. The problem is that animals die and there will not be water.")

"Las personas cortan los árboles para hacer su vivienda y poner al ganado. No hay vida en el bosque y contaminan al medio ambiente."

("People cut down trees to make a living and put their cows there. There is no life in the forest and the environment is contaminated.")

¿Por qué las personas cortan los árboles, y qué problemas resultan?

(Why do people cut down trees, and what problems result?)

E.2: Los estudiantes de Punta Hacienda

(E.2: Students from Punta Hacienda)

"El árbol nos sirve para dar fruto y para jugar, para los animales, para darnos aire, para darnos oxígeno"

("The trees gives us fruit and play, for the animals, to give us air, to give us oxygen")

"Que no tenemos que cortar los árboles, sino que tenemos que sembrar para respirar aire limpio y también que nos da frutas"

("We don't have to cut down the trees, but rather we have to plant them to breathe clean air and also for them to give us fruits")

"Sin los árboles no podemos vivir no podemos contaminar el medioambiente"

("Without the trees we cannot live, we cannot contaminate the environment")

¿Qué funciones sirven los árboles?

(What functions do trees serve?)